School of Electrical and Information Engineering
University of the Witwatersrand, Johannesburg
ELEN4002/4012: EIE Investigation (Capstone Project) 2022

Tender Bid for Project Number: 22P30

Project Title: Sign Language Translator for the Hearing and Speech Impaired

Group Number: 22G05

Project Overview:

In order to fully appreciate the extent of this project, research will have to be undertaken regarding South African sign language (SASL). While it is not (yet) one of South Africa's official languages, it is recognized as a teaching-subject in schools and universities across South Africa. With all this in mind, it is obvious that developing systems that will enable the translation of SASL into audible speech is invaluable to not only the deaf community, but all communities of this country. Further research will be conducted to discover if there are any current solutions to developing such a system (that can, for example, translate hand signals and movements). The design of the image capturing techniques, separation and analysis of the inputted data will need to be planned and complex algorithms developed. A dataset and database will need to be captured, designed and developed that will best contain and allow for ease of analysis of the data. From here, software will need to be investigated and designed that will convert the processed signals into audio speech signals (and text output if possible). This entire system will need to be one self-contained and portable program. As with any video recording and use of personal data, ethics applications and waivers will need to be developed and agreed to by all parties. The final stage of the project will be testing the system in order to ensure a product of high enough accuracy, as incorrect translations would be detrimental to such an important project.

Preliminary Budget & Resources:

Fortunately, the University of Witwatersrand (Wits) has many of the required resources for this project readily available. The incredible ESD laboratory and other computer and software components available to students allow for the cost of this project to remain low.

If anything, the major cost will include any costs of software not provided by Wits that is required to perform the image capturing, data processing and data conversion required. However, since Python is the preferred programming language for such applications (especially in the machine learning field), most libraries are open source and free to use and develop further.

An image processing library will be required to analyze and manipulate the input (video data for example) and convert it into a data format so that a database can be developed. This will require database software; fortunately, open-source software such as MySQL and Cassandra are available for students for free.

Depending on how the data is captured, and whether it must be done within this project (or if it is provided beforehand) hardware resources might be required, such as a camera.

Weekly Milestones:

Week 1: Perform thorough research into SASL, as well as the software requirements and solutions. Ensure all plans and deliverables are completely in-line with the standards, ethics and requirements of the deaf-community.

Week 2: Start designing image processing techniques (if necessary) and finalize what software will be used.

Week 3: Begin collecting data (if necessary) and storing it into the database – develop the dataset that will be analyzed as well as data analysis techniques.

Week 4-6: Start developing the software: image processing, data analysis, signal processing, audio processing and output, text generation and output, etc. Ensure to develop tests and other checks that always ensure the utmost accuracy and quality output.

Week 7-8: Finalize the software and start performing final quality and accuracy tests.

Risks and Mitigation:

The biggest and most important risk to consider with this project includes the miss-translation of the inputted sign language. A high rate of miss-translation is unacceptable and will not be considered a successful solution. Mitigating this will require accurate data input, well-programmed software solution, and continuous input from the deaf-community and professional SASL contact that checks the accuracy of the output of the system. Fortunately, one of the students has a SASL contact that would be willing to provide this quality assurance if Wits is unable to provide such a person.

Further, the emotions conveyed when communicating with SASL are often entirely based on facial expressions and body gestures, which is incredibly difficult to convey using a generated audio and text output. This is another risk that is related to the miss-communication of such a system and must be closely monitored to ensure that the inaccuracies are minimal.

As mentioned, the use of video recording and use of personal data provides ethical considerations that must be adhered to at all times.