SIGN LANGUAGE TO VOICE TRANSLATOR

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THE PROBLEM AND ITS BACKGROUND

Deaf people suffered many discrimination even the history itself have witnessed such. Centuries-long struggle, deaf people does not allow to participate fully in the rituals of the temple, denied the property rights, and not allowed to be witness in the courts. According to Plato, all intelligence was present at birth, without speech there was no outward sign of intelligence, so deaf people must not be capable of ideas or language. Aristotle said that deaf people could not be educated without hearing, people could not learn and those born deaf become senseless and incapable of reason. Early Christians see deafness as sin. Saint Augustine tells early Christians that deaf children are a sign of God's anger at the sins of their parents. It was a belief that people born deaf could not have faith, could not be saved and were barred from churches.

Early 1500's, the ability of the deaf to reason have been recognized. They have developed their own form of language, the sign language. The start of opportunities for the hearing-impaired spread out to New York, Pennsylvania, Kentucky, Ohio and Virginia in the early 1800. Deaf education in the late 1800 was gain more support and have their national deaf-mute college, the Gallaudet College.

The cochlear invention turned the 30,000 individuals to implant technology in the mid of 2006. It cost as much as US $40,000 (Php 1,660,000) in America while AUD $30,000 in Australia during 2009.

Employment opportunities for deaf and hearing impaired people are significantly less than for hearing applicants, according to the 4th world congress on Mental Health and Deafness.

Attitudinal and environmental barriers, not the physical impairment, prevent people with disabilities from enjoying full human rights; for Deaf people the major barrier is lack of recognition, acceptance and use of sign language in all areas of life, and lack of respect for Deaf people's cultural and linguistic identity (Haualand, H. and Allen, C.).

For Deaf people, barriers to access are rarely about physical obstacles. More often the barriers will be found in lack of accessible information, whether this information comes through direct interaction with other people who do not know or use sign language, or from sources that are intended to reach many people at once, e.g. the mass media (Haualand, H. and Allen, C.).

In the Philippines, efforts to help person with disabiltiies (PWDs) were renewed via the amended Magna Carta for PWDs (Republic Act 9442) passed in April 2007. This legislation aims to fully integrate differently abled persons into the mainstream of Philippine society (PIDS).

Over twelve million people (Gordon) in the Philippines suffer and as what the researches suggested and revealed they have to use sign language to communicate and only few among those normal know the language. Since there are this language barrier among deaf people and normal people, the proponent is focusing on how to lessen the gap between the groups.

Technologies are widely spread among nations and they are invading the globe. The proponent is thinking about using those technologies to minimize the gap of sign language and the normal language users. The conceptualization of sign language to voice translator have emerge.

DESIGN OBJECTIVES

General Objective

To come up with engineering design and technology in sign language to voice translator.

Specific Objectives

1. To study the different sign languages used in the country.
2. To determine the technology available in the market that fits and can be use in the project.
3. To design or layout the target project.
4. To determine the process included
5. To develop a project plan
6. To evaluate the tehno-economic viability
7. To formulate an algorithm design of the project

DESIGN CONSIDERATIONS

Hand gestures play an important role in communication between people during their daily lives. But the extensive use of hand gestures as a mean of communication can be found in *sign languages*. Sign language is the basic communication method between deaf people. Sign language is the natural language of deaf people wherein the hands convey most of the information (Fillbrandt, H., et al). A translator is usually needed when an ordinary person wants to communicate with a deaf one.

In recent years, more and more national languages have begun to be officially recognised in the countries where they are used, as they are the primary means of communication for deaf people (Morrisey,S. and Way A.). Regrettably, in many others "provision is not made for deaf people to access public information, or receive vital services such as education and health in their first language" (O"baoill, D. and Matthews, P. A.), namely sign language.

The Ethnologue (Gordon) contains a comprehensive listing of the world's languages as far as they are known, including more than one hundred signed languages. Only one sign language is listed for the Philippines, called either Philippine Sign Language or Filipino Signed Language (FSL). According to (Lewis, Ethnologue: Languages of the World, Sixteenth Edition), Deaf population of the Philippines reaches

12,914,601. According to (Hurlbut), from the survey conducted revealed that there are two signed languages in the Philippines: Filipino Sign Language (FSL) and Samar Sign Language or San Julian Sign Language.

American Sign Language (ASL) is the language choice for most deaf in the United States. It uses approximately 6,000 gestures for common words and finger spelling for communicating obscure words or proper nouns (Starner, T., Weaver, J., and Pentland, A.). . Previous study have concentrated on obtaining the hands by using their skin colour (Starner, T., Weaver, J., and Pentland, A.). Gestures are represented by a sequence of critical points (local minima and maxima) of the motion of the hand and wrist (Watson, R., and O'neill, P.). In sign language meaning is conveyed using several parts of the body in parallel (Huenerfauth), not solely the hands which is a common misconception, but the SL phonemes are articulated using the hands and example of those include hand shape and palm orientation (Morrisey,S. and Way A.). According to Stokoe's analysis of ASL, four of the parameters are posture, position, orientation and motion (Stokoe).

Linguistic research in sign language has shown that signs mainly consist of four basic manual components: hand configuration, place of articulation, hand movement, and hand orientation (Stokoe, W., Casterline, D., and Croneberg, C.). The proponent is following the concepts behind the Oklahoma University's Engineering Design Cycle which is shown below.

Figure 1 Engineering Design Cycle

Researching

Information about the project has been acquired from books, web, articles and other related studies taken from online journals.

The researcher have searched and read about some history of deaf, from the century-long struggle of deaf people for their rights, discrimination even in church, up to the opportunities given to them to be part of the society. The deaf society has formulated their own language in which now a days it was already recognized by the government of every nation.

Research was focused on the methods used in interpreting the sign language used by the deaf people. It was found out that different group have their own formulation of their sign language. Hand sign language as what the researcher have proposed, has been only a part of the conversation wherein it articulated the SL phonemes (Morrisey,S. and Way A.). It was not solely the hand conveyed the meaning of the sign language but using several parts of the body in parallel (Huenerfauth). Facial expression, body movement, and gestures are among others to consider in interpreting such sign language.

American Sign Language (ASL) is the common sign language around the globe. Filipino Sign Language is the sign language used by the Filipino which is based on ASL (GARCIA).

Modelling

Different parameters were acquired from the different related studies taken from online journals. These include hand configuration, place of articulation, hand movement, and hand orientation (Stokoe, W., Casterline, D., and Croneberg, C.), several parts of the body in parallel (Huenerfauth), gestures for common words (Watson, R., and O'neill, P.), and even the skin colour (Starner, T., Weaver, J., and Pentland, A.).

The researcher has found this deaf dictionary online, where there is a video of each term. It was a big help to the project since the researcher has very limited knowledge about sign language. Watching the videos of those terms, some signs were able to study and familiarized. Hand shape, length of fingers, and palm size affects the sign language as what the researcher perceived on the videos which was supported by the study of (Morrisey,S. and Way A.) about articulation of phonemes by hands which are affected by the shape of hands and the palm orientation.

Plan of having an actual conversation with deaf and an interpreter is looking forward for a better understanding of the language. The researcher is also looking at the possibility of enrolling to a short course in sing language as schedule and time permit.

The project will have a prototype as a model and will be having an actual testing on it. The project will under go a series of testing and evaluation. Deaf individual or an interpreter of the sign language will be asked for some assistance to evaluate the project. The project will be evaluated according to the usability, reliability in terms of speed and correctness of the translated terms, efficiency and user-friendliness. Using the 5-point Likert Scale, the evaluator will have a checklist of the said testing parameters for the project to have a better evaluation from the intended user of the project.

Implementation

The project will have a prototype as a model and will be having an actual testing on it. Injecting and incorporating those in the researches, the parameters, hindrances and other factors affecting the feasibility of the project will be done. The project will under go a series of testing and evaluation. Deaf individual or an interpreter of the sign language will be asked for some assistance to evaluate the project. The project will be evaluated according to the usability, reliability in terms of speed and correctness of the translated terms, efficiency and user-friendliness. Using the 5-point Likert Scale, the evaluator will have a checklist of the said testing parameters for the project to have a better evaluation from the intended user of the project.

Measuring

Standards on the usability, reliability, efficiency and user-friendliness will be subject for comparison for the measurement of those parameters for the project to pass on the global standard. It will again subject for the actual implementation with an actual deaf.

Communicating

Users of the project will ask for some criticism about the prototype and also for some suggestions to further improvement. Along some negotiations in the development of the project, the researcher will again reiterate the cycle until perfection.
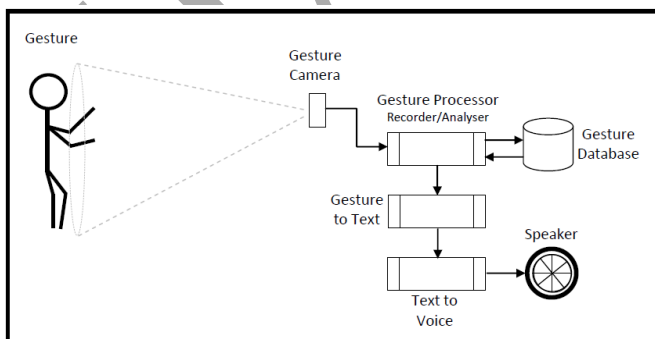
DESIGN PROPER

Figure 2 Conceptual Framework

Figure 2 shows the conceptual framework of the project. The gesture camera will capture the gesture of the deaf and record it for filling on the database. It will be same in the process of analysing the gesture but it will be differ on the process of comparison of the captured gesture and the saved gesture. Once the comparison is successful, it will pass to the next process, else it will prompt an error message or an error sound. The next process after the successful entry of the gesture is the conversion of the captured gesture to text for easy translation to voice and will output to the attached speaker.

Design Algorithm

MAIN Process
Initialization of variables
Initialization of devices
Checking the connection of the devices
    If not connected nor found
        Display the necessary error message
        Exit the process
BEGIN: Choose option record or option translate
    If record
        Call process to RECORD
        Go to BEGIN
    Else If translate
        Call process to TRANSLATE
        Go to BEGIN
    Else
        Exit the process

RECORD Process
Initialization of variables
    Display the procedures in recording
    Proceed to step 1: start point of the sign
    Proceed to step 2: the second unique point of the sign
    Proceed to step 3: the third unique point of the sign
    Proceed to step n: the nth unique point of the sign
Save the captured sign in the database
Exit the process

TRANSLATE Process
Initialization of variables
    Display the procedures in translating
    Fetch the sign from the sing camera
    Compare the fetched sign in the database of signs
        If found
            Fetch the equivalent text
            Send text to the voice manager
        Else If not found
            Display the necessary error messages
            Exit the process
Exit the process

Project execution plan

	Activities	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
A. Researching	A.1. Data Gathering	X	X															
	A.2. Filtering		X	X														
	A.3. Consolidating				X													
B. Modelling	B.1. Formulation of Algorithm				X	X												
	B.2. Translation to Pseudocode/ Source Code					X	X											
C. Implementing	C.1. Identification of materials		X	X	X													
	C.2. Checking the Availability of materials				X	X												
	C.3. Acquisition of the materials							X										
	C.4. Installation of the Materials								X	X								
	C.5. Intergration of the Hardware and Software										X	X						
D. Measuring	D.1. Testing the System												X	X				
	D.2. Modification and correction													X	X			
E. Communicating	E.1. Evaluation of the System															X		
	E.2. Packaging of the product																X	X

Table 1 Gantt Chart

Table 1 presents the project plan. It follows the phase in the engineering design cycle used in this study. The different activities have been identified and will be done in the time allotted in the chart. It has been gone through approximately seventeen (17) weeks but it will still depends on the availability of the materials needed in the project and other hindrances in the development of the project.

PRESENTATION AND INTERPRETATION OF RESULTS

Studied the different sign languages used in the country.

American Sign Language (ASL) is the language used by most deaf in the Philippines which comprised the 60 percent of deaf people while the Filipino Sign Language (FSL) is used by the other 40 percent as of the year 2007. Today, there are 54 percent of the total population of deaf in the Philippines uses the FSL compared to ASL (GARCIA).

Determined the Technology in the Market that Fits and can be use in the Project.

Xbox 360 of Nintendo would be a great help in the project since it has the capability to track the motion of the player in the Kinnect Gaming by Microsoft (Microsoft).

Leap is the newest technology that could track fingers in motion but not yet available in the market. It will soon be release in the market at the late December 2012 or in the early January of the following year (Leap Motion).

Design of the Project

Based on Figure 2 Conceptual Framework of the Project, the researcher will design that will fit on the concepts behind the framework. The idea was to make the project as portable as it can be. Therefore, it should be lighter and smaller.

Determined the Included Processes

Based on the conceptual framework (figure 2), there are four processes needed in the system; Recording Process, Analysing Via Comparing Process, Gesture to Text Process and Text to Voice Process.

Developed Project Plan

This project has a project execution plan. It was formulated in the form of Gantt chart. The plan was to finish the project in seventeen (17) weeks.

Evaluation of the Tehno-Economic Viability

The total population of the Republic of the Philippines is 84,566,000 and the population of deaf in the Philippines is 12,914,601 (Lewis, Ethnologue: Languages of the World, Sixteenth Edition), which is 15.27 percent. Therefore the need of the Philippines in this kind of project is higher since it reaches up to more than 15 percent of the population.

CONCLUSIONS AND RECOMMENDATION

Conclusions

1. Filipino Sign Language is the language of most deaf Filipino, yet they are still using the ASL and Signing Exact English (SEE).
2. Xbox 360 and Leap technologies were identified to be fit and can be used in the project.
3. Design of the project was based on the conceptual framework.
4. There are four processes identified to be included in the system.
5. GANTT Chart was formulated and use as guide in the development of the project
6. The project is Technologically viable and Economically viable.

Recommendations

1. Another study should be conducted on the verbal communication to sign language translation.
2. Make the project available in a handheld device e.g. mobile phone.

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