

BUSITEMA UNIVERSITY
FACULTY OF ENGINEERING
DEPARTMENT OF COMPUTER ENGINEERING

GESTURE TO SPEECH TRANSLATION APPLICATION

SUBMITTED

BY

MUSIIMENTA ODITH

Tel no: 0706767768/0778211337

SUPERVISOR: MR. BWIRE FELIX

**A project Report submitted to the Department of Computer Engineering in Partial
fulfillment of the requirements for the award of Bachelor's degree in Computer
Engineering at Busitema**

University

May 2017

DECLARATION

I, Musiimenta Odith do hereby declare that this Project Report is original and has not been submitted for any other degree award to any other University before.

Signature.....Date.....

Musiimenta Odith

Bachelor of Computer Engineering

Busitema University.

APPROVAL

This Project Report has been submitted with the approval of the following supervisor(s).

SignatureDate:

Mr. Bwire Felix

Department of Computer Engineering

Faculty of Engineering

Busitema University.

ACKNOWLEDGEMENT

First of all I thank the almighty God for the health knowledge and provision through this whole project preparation period, may His name be glorified. Secondly I thank my dad and mum for the providence of research/project costs, encouragement, care and love.

Special thanks to my supervisor; Mr. Bwire Felix who guided me through the proposal, development and implementation stages, I appreciate.

I also wish to thank the entire Department of Computer Engineering for the guidance, knowledge and support through report making, project development and implementation stages.

Lastly but not least, the ICT Department of Busitema University, who provided the internet access resource, this greatly helped me in my research works. May the Almighty bless all of you abundantly.

DEDICATION

To My parents Mr. and Mrs. Mwesigye

I will forever be grateful for the enduring Love, care and support you have always offered.

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LIST OF ACRONYMS

- ASL: American Sign Language
- ASR: Automatic Speech Recognition
- ASU: Automatic Speech Understanding
- BSL: British Sign Language
- CV: Computer Vision
- FD: Fourier descriptor
- HMM: Hidden Markov Models
- IR: Infrared
- LCD: Liquid Cristal Display
- LED: Light Emitting Diode
- MT: Machine Translation
- RBMT: Rule-Based Machine Translation
- SMT: Statistical Machine Translation
- TTS: Text-to-speech
- TTS: Text-to-Speech Synthesis
- USB: Universal Serial Bus
- USL: Ugandan Sign Language

ABSTRACT

Deaf people make up a good portion of the world's population and their involvement in community activities is highly required by society. The deaf need to feel like other normal people and this starts with working on how they communicate with the normal hearing people. The major goal of the Hand Gesture to Speech Translation Application was to translate the hand gestures to speech. The Hand Gesture to Speech Translation Application, was developed using unity3D development environment and it helps the deaf communicate to the normal hearing people with no knowledge of sign language, by translating the performed hand(s) gestures to English speech. The user is also able to visualize his hand(s) in real time as he or she is performing the gestures. The application was tested, verified and validated. Accuracy obtained was 70%.

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CHAPTER ONE

INTRODUCTION

1.1 Background

Since their existence, humans have been physically and mentally challenged with various impediments that hinder their advancement on all economic, political, and social level [1]. About three hundred sixty million people worldwide suffer from a condition known as hearing loss [2], these are referred to as the deaf. A deaf person is one with profound hearing loss, which implies very little or no hearing [3]. The causes of hearing loss are both congenital causes and acquired causes. This leaves the deaf with only the option of using sign language to communicate. Sign language is a system of communication that uses visual gestures and signs as used by the deaf. It's a combination of shapes and movements of different parts of the body, these parts include face and hands. The area of performance of the movements may be from above the head to the belt level. Signs are used in a sign language to communicate words and sentences to audience [4]. A sign language usually provides signs for whole words, it also provides signs of letters to perform words that don't have a corresponding sign in that sign language. So, although sentences can be made using the signs for letters, performing with signs of words is faster [4]. A gesture in a sign language, is a particular movement of the hands with a specific shape made out of them. Facial expressions also count toward the gesture, at the same time. A posture on the other hand, is a static shape of the hand to indicate a sign

While many deaf persons communicate effectively using a form of sign language or the fingerspelling alphabet, problems arise when a hearing person, who does not know sign language, attempts to interact with a deaf individual who does not know the "oral" method. These communication difficulties adversely affect interpersonal relationships and vocational activities. Consequently, many deaf people avoid situations requiring interaction with hearing persons. These disabled individuals often remain unemployed, dependent and cannot fully participate in community life [5].

Uganda was the second country in the world to recognize Sign Language in its constitution, in 1995[6]. A Ugandan Sign Language Dictionary has been published and Schools set up where these people learn the Ugandan Sign Language (USL) as a mother tongue and English as a foreign

REFERENCES

- [1] E. Apter, *The Translation Zone: A New Comparative Literature*. Princeton University Press, 2011.
- [2] H. Lane and B. Bahan, "Article Commentary: Ethics of cochlear implantation in young children: A review and reply from a Deaf-World perspective," *Otolaryngology—Head and Neck Surgery*, vol. 119, no. 4, pp. 297-313, 2012.
- [3] B. Bain, *The sociogenesis of language and human conduct*. Springer Science & Business Media, 2013.
- [4] S. A. Mehdi and Y. N. Khan, "Sign language recognition using sensor gloves," in *Neural Information Processing, 2002. ICONIP'02. Proceedings of the 9th International Conference on*, 2002, vol. 5, pp. 2204-2206: IEEE.
- [5] J. Kramer and L. Leifer, "The talking glove," *ACM SIGCAPH Computers and the Physically Handicapped*, no. 39, pp. 12-16, 1988.
- [6] S. Lutalo Kiingi, "A descriptive grammar of morphosyntactic constructions in Ugandan Sign Language (UgSL)," University of Central Lancashire, 2014.
- [7] A. Kusters, M. De Meulder, and D. O'Brien, "Innovations in Deaf Studies: Critically Mapping the Field," *Innovation in Deaf Studies: the Role of Deaf Scholars*, p. 1, 2017.
- [8] J. G. Elias, W. C. Westerman, and M. M. Haggerty, "Multi-touch gesture dictionary," ed: Google Patents, 2010.
- [9] S. J. Taylor, R. Bogdan, and M. DeVault, *Introduction to qualitative research methods: A guidebook and resource*. John Wiley & Sons, 2015.
- [10] A. S.-L.-H. Association, "Scope of practice in speech-language pathology," 2016.
- [11] F. Pöchhacker, *Introducing interpreting studies*. Routledge, 2016.
- [12] D. Jurafsky, "Speech and language processing: An introduction to natural language processing," *Computational linguistics, and speech recognition*, 2000.
- [13] K. S. Yadav and M. Mukhedkar, "Review on speech recognition," *International Journal of Science and Engineering*, vol. 1, no. 2, pp. 61-70, 2013.
- [14] P. Koehn *et al.*, "Moses: Open source toolkit for statistical machine translation," in *Proceedings of the 45th annual meeting of the ACL on interactive poster and demonstration sessions*, 2007, pp. 177-180: Association for Computational Linguistics.

- [15] W. Daelemans and A. Van den Bosch, *Memory-based language processing*. Cambridge University Press, 2005.
- [16] B. S. Parton, "Sign language recognition and translation: A multidisciplinary approach from the field of artificial intelligence," *Journal of deaf studies and deaf education*, vol. 11, no. 1, pp. 94-101, 2006.
- [17] P. Kishore and P. R. Kumar, "A video based Indian Sign Language Recognition System (INSLR) using wavelet transform and fuzzy logic," *International Journal of Engineering and Technology*, vol. 4, no. 5, p. 537, 2012.
- [18] P. Kishore, M. Prasad, C. R. Prasad, and R. Rahul, "4-Camera model for sign language recognition using elliptical fourier descriptors and ANN," in *Signal Processing And Communication Engineering Systems (SPACES), 2015 International Conference on*, 2015, pp. 34-38: IEEE.
- [19] J. M. S. Dias, P. Nande, N. Barata, and A. Correia, "OGRE-open gestures recognition engine," in *Computer graphics and image processing, 2004. Proceedings. 17th Brazilian Symposium on*, 2004, pp. 33-40: IEEE.
- [20] M. Hruz *et al.*, "Automatic fingersign-to-speech translation system," *Journal on Multimodal User Interfaces*, vol. 4, no. 2, pp. 61-79, 2011.
- [21] F.-S. Chen, C.-M. Fu, and C.-L. Huang, "Hand gesture recognition using a real-time tracking method and hidden Markov models," *Image and vision computing*, vol. 21, no. 8, pp. 745-758, 2003.
- [22] J. Field, "Listening in the language classroom," *ELT journal*, vol. 64, no. 3, pp. 331-333, 2010.
- [23] O. Johansson, "Disturbance of the immune system by electromagnetic fields—A potentially underlying cause for cellular damage and tissue repair reduction which could lead to disease and impairment," *Pathophysiology*, vol. 16, no. 2, pp. 157-177, 2009.
- [24] G. Salvendy, *Handbook of human factors and ergonomics*. John Wiley & Sons, 2012.