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FACULTY OF ENGINEERING  
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ENGLISH TO RUNYANKOLE SPEECH TRANSLATION SYSTEM

BY

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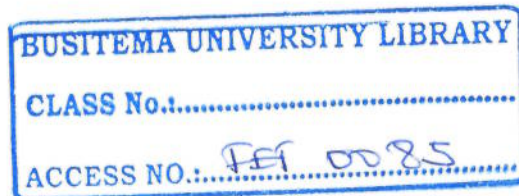
JUNE, 2016

### Declaration

I MUHOOZI DENIS BU/UG/2012/76 hereby declare that this project report is my original work except where explicit citation has been made and it has not been presented to any Institution of higher learning for any academic award.

Sign: *Muhoozi*.....

Date: *08th June, 2016*.....




## Approval

This is to certify that the project report under the title "ENGLISH TO RUNYANKOLE SPEECH TRANSLATION SYSTEM" has been done under my supervision and is now ready for examination.

MR. ARINEITWE JOSHUA

Department of Computer Engineering

Sign: .....  .....

Date: ..... 08/06/2016 .....

## Acknowledgement

That I should hand over this report without the acknowledgement of these great personalities and beings is so monstrous that it would cripple the one receiving them. Therefore I thank the following with all my heart, body and soul and spirit respectively from the order of precedence:

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## **Dedication**

This project report is dedicated to my dearly beloved parents chosen by God before the beginning of time Mr. Muhoozi Elias and Mrs. Phoebe Kafarasi for their tireless effort of continuing with the responsibility God gave them till this time.

### **List of acronyms**

ASR	AUTOMATIC SPEECH RECOGNITION
ASU	AUTOMATIC SPEECH UNDERSTANDING
CBMT	CORPUS BASED MACHINE TRANSLATION
EBMT	EXAMPLE BASED MACHINE TRANSLATION
ELRA	EUROPEAN LANGUAGE RESOURCES ASSOCIATION
MT	MACHINE TRANSLATION
NICT	NATIONAL INSTITUTE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
NLP	NATURAL LANGUAGE PROCESSING
RBMT	RULE-BASED MACHINE TRANSLATION
SMT	STATISTICAL-BASED MACHINE TRANSLATION
SST	SPEECH TO SPEECH TRANSLATION
TTS	TEXT TO SPEECH SYNTHESIS

## List of figures

Figure 2.1: Phonetic Representation-based Speech Translation .....	5
Figure 2.2: Typical Speech Recognition Procedure [12] .....	6
Figure 2.3: Block diagram of TTS system .....	11
Figure 2.4: Text Synthesis cycle .....	11
Figure 3.1: Block diagram of English to Runyankole Speech Translation System.....	15
Figure 3.2: Conceptual diagram of Speech translation system .....	16
Figure 4.1: Flow chart of the system.....	19
Figure 4.2: Class diagram of the system .....	20
Figure 4.3: Use case diagram .....	20
Figure 4.4: Speech wave forms of the words and sentences in speech.....	22
Figure 4.5: Appearance of system after being used .....	25

## **Abstract**

The report covers the developed system which is English to Runyankole speech translation system that aimed at developing a desktop application called "TRANSTOOL" that inputs English speech and then outputs Runyankole speech maintaining the voice of the speaker. English to Runyankole speech translation system was developed to meet the main objective of translation English speech to Runyankole speech. The project utilizes the basic concepts of speech processing such as speech recognition and speech synthesis. The main pushing factor for this system was language barrier and after development, the system enables an English person to speak specified English words and they are translated to Runyankole. This aims at reducing the language gap between the English language and Runyankole language thus facilitating effective communication in the socio-economic, political and cultural interaction. This project has been implemented in Visual Studio 2012 as the integrated development environment and C# as the programming language. The operating system being windows 8.1. Since language barrier was and has been the major challenge for English speaking foreigners and native Ugandans who don't know how to speak Runyankole, this system was developed to solve this issue. Learning a language takes a lot of time as well as resources such as money as facilitation fee. On the same note hiring an interpreter is costly. This system has been developed to reduce those expenses.



## Table of Contents

Declaration.....	i
Approval.....	ii
Dedication.....	iv
List of acronyms.....	v
List of figures.....	vi
Abstract.....	vii
Chapter One: Introduction.....	1
1.1    Background.....	1
1.2    Problem statement.....	1
1.3    Objectives.....	1
1.3.1    Main objective.....	1
1.3.2    Specific objective.....	2
1.4    Significance/justification.....	2
1.5    Scope.....	2
1.6    Limitations.....	3
Chapter Two: Literature Review.....	4
2.1    Definitions, descriptions and concepts.....	4
2.1.1    Speech to speech/ spoken language translation.....	4
2.1.3    Automatic speech recognition (ASR):.....	6
2.1.4    Machine translation.....	8
2.1.5    Speech synthesis.....	10
2.2    The existing speech translation systems.....	12
2.2.1    Safarini translator mobile app:.....	12
2.2.2    Microsoft's translation breakthrough:.....	12
2.2.3    Microsoft skype translator:.....	12
2.2.4    Chatra:.....	12
2.2.5    Google translate:.....	12
2.3    Weaknesses in the existing systems.....	12

2.4	The developed system.....	13
2.5	Technologies used:.....	13
2.5.1	Dotnet framework:.....	13
Chapter Three: Methodology.....		14
3.1	Requirements elicitation.....	14
3.2	Requirements analysis.....	14
3.3	System design.....	14
3.3.1	Design and development tools.....	14
3.3.2	Block diagram.....	15
3.3.3	Conceptual framework of the system.....	16
3.4	System implementation.....	16
3.5	Testing and verification.....	16
3.6	Validation.....	17
Chapter Four: System Analysis and Design.....		18
4.1	Requirements analysis.....	18
4.1.1	Functional requirements.....	18
4.1.2	Non- functional requirements.....	18
4.2	System Design and Development.....	19
4.2.1	System flow chart.....	19
4.2.2	Class diagram.....	20
4.2.3	Use case Diagram.....	20
4.3	Development Tools.....	21
4.4	Code Designs.....	23
4.5	System Testing.....	24
4.7	System Validation.....	25
4.8	System evaluation.....	25
Chapter Five: Discussion and Recommendations.....		26
3.1	Summary of the work.....	26
3.1.1	Choosing the project.....	26

5.1.2	Planning, executing and management of project.....	26
5.1.3	Documentation.....	26
5.2	Challenges.....	27
5.3	Recommendations for future work.....	27
5.4	Conclusion.....	28
Appendix 1	.....	31
a)	Interface of system during operation.....	31
Appendix 2	.....	32
Main code for the system	.....	32

## **Chapter One: Introduction**

### **1.1 Background**

During the time I first heard about the coming of foreigners to Africa in primary four 2002, the major problem mentioned was language barrier. The problem persisted until now when I am of a view that it should not be mentioned among the problems limiting interaction of people of different languages in the 21st century.

According to the 2005 edition of Ethnologue, there are 6,912 living languages in the world [1]. According to the 2015 edition of Ethnologue, Uganda has a total of 41 living languages [2]. A living language is one that has at least one speaker for whom it is their first language. The languages are concentrated in the regions of Uganda as follows; Runyankole-Rukigã, Rutooro, Runyoro, Rukonjo in Western Uganda, Luganda in Buganda region, Lusoga in Busoga sub-region, Lugisu, Samia, Ateso, Kumam, Lunyole, Lugbara in Eastern region, Alur, Langi, Luo, Karimojong, in Northern Uganda, among other local languages. Kiswahili, English are the official languages being taught in schools.

Majority of the local people understand their native language compared to the smaller elite English speaking group.

### **1.2 Problem statement**

People of different languages in Uganda face limitations due to language business as they interact in the following unavoidable encounters such as: business, political campaigns, religious preaching, social addressing, patient-doctor interactions, oral research interviews and other human interactions. This limitation which is a problem is called language barrier.

Currently Human interpreters are employed to solve the problem by escorting the person wherever he goes to perform translation. This is not cost effective and at times the original message is distorted. Thus this system was developed to replace the human interpreter to facilitate better communication in real time.

### **1.3 Objectives**

#### **1.3.1 Main objective**

To design and implement a system that translates English speech to Runyankole speech.

## REFERENCES

- [1] [http://www.ling.upenn.edu/courses/Fall\\_2011/ling001/world\\_languages.html](http://www.ling.upenn.edu/courses/Fall_2011/ling001/world_languages.html).
- [2] "<http://www.ethnologue.com/country/UG>," 2015.
- [3] AHMED, "New Advances in Spoken Language Translation," CENTRE FOR NEXT GENERATION LOCALISATION, 2013.
- [4] D. Anastasiou, "Survey on Speech, Machine Translation and Gestures in Ambient Assisted Living," 4 March 2011.
- [5] S. Federico, "Overview of the IWSLT 2011 Evaluation Campaign," in Proceedings IWSLT 2011, San Francisco, 2011.
- [6] Federico, "Overview of the IWSLT 2012 Evaluation Campaign," in Proceedings IWSLT, Hong Kong, 2012.
- [7] Casacuberta, "Some approaches to statistical and finite-state speech-to-speech translation.18," in Computer Speech and Language (Elsevier) , Francisco, 2004.
- [8] Ahmed, "Hierarchical Phrase-Based MT for Phonetic Representation-Based Speech Translation," in Proceedings of Tenth Biennial Conference of the Association for Machine Translation in the (AMTA), San Diego, 2012.
- [9] Ahmed, "Phonetic Representation-Based Speech Translation," in Proceedings of 13th Machine Translation Summit, Xiamen, 2011.
- [10] Dimitra, "Survey on Speech, Machine Translation and Gestures in Ambient Assisted Living," 2011.
- [11] Jurafsky, Speech and Language Processing: An Introduction to Natural Language Processing, Speech Recognition, and Computational Linguistics,2nd edition., Prentice-Hall, 2009.
- [12] R. S. Bhiksha Raj, Design and Implementation of Speech Recognition Systems, 2011.
- [13] <http://www.jisc.ac.uk/media/documents/techwatch/ruchi.pdf>.
- [14] "Machine Translation," [Online]. Available: <http://nlp.stanford.edu/projects/mt.shtml>. [Accessed 1 11 2015].
- [15] "Machine Translation Approaches: Issues and Challenges," IJCSI International Journal of Computer Science Issues,September , Vols. Vol. 11,No 2, no. Issue 5, 2014.
- [16] Rwothungeyo, "www.newvision.co.ug," New Vision, 28 October 2015. [Online]. Available: <http://www.newvision.co.ug/news/667997-ugandan-develops-language-translating-app.html>. [Accessed 28 October 2015].
- [17] Meyer, "Microsoft's translation breakthrough: Speak, and hear your voice in Chinese." <http://www.zdnet.com/article/microsofts-translation-breakthrough-speak-and-hear-your->



voice-in-chinese/, 9 November 2012.

- [18] [Online]. Available: <http://blogs.skype.com/2014/12/15/skype-translator-preview-an-exciting-journey-to-a-new-chapter-in-communication/>. [Accessed 28 10 2015].
- [19] Hachman, PCWorld, 1 10 2015. [Online]. Available: <http://www.peworld.com/article/2988552/software-web/skypes-magic-real-time-speech-translation-is-going-live-for-all.html>. [Accessed 6 11 2015].
- [20] "Trends In Japan," [Online]. Available: [http://web-japan.org/trends/11\\_sci-tech/sci120126.html](http://web-japan.org/trends/11_sci-tech/sci120126.html). [Accessed 28 10 2015].
- [21] [Online]. Available: <https://translate.google.com/>. [Accessed 28 10 2015].
- [22] [Online]. Available: [www.support.microsoft.com/common/international.aspx](http://www.support.microsoft.com/common/international.aspx). [Accessed 20 04 2016].
- [23] M. Heck, "Automatic Language Identification for Natural Speech Processing Systems," 01. June 2011 – 01. September 2011.
- [24] "Sphinx," [Online]. Available: <http://www.speech.cs.cmu.edu/sphinx/Sphinx.htm>.