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Review of Ubiquitous Speech Based Translations for Language Learners

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Abstract
Ubiquitous speech based translations for language learners facilitate real-time communication through translating spoken words from one language to another, offering significant potential for enhancing language learning and supporting multilingual interactions. It has significant impact on global communication and everyday interactions. Ubiquitous system is designed to be available and functional in a wide range of situations and locations. This means learners can access translation support in various contexts, whether in the market, on the road, in the offices or in social gathering seamlessly. Yoruba Language will be emphasized in this work, it is one of the under-resource languages and that are not widely known, mostly spoken in the western part of Nigeria and some parts in West Africa. Non indigenes are facing a major language barrier mostly in remote areas where most people speak only Yoruba Language. The critical need to sustain these low-resourced languages are highly required because some of these Languages are going nonextant; Ubiquitous Computing (UC) and Natural Language Processing (NLP) can tackle the problem. This work aims to offer a review of how ubiquitous speech based translations can transform learning experiences and suggests pathways for advancing these tools to better serve language learners. It also highlights future research directions, such as the need for more sophisticated algorithms, methodologies or models, better integration with other communication tools to increase the knowledge base on speech based translations for further studies.

Keywords: *Ubiquitous, Automatic Speech Recognition (ASR), Machine Translation (MT), Natural Language Processing (NLP), Speech Synthesis.*

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I. INTRODUCTION

The majority of language processing technology attempts at the moment are concentrated on western languages, such English and French, even if these languages already have resources accessible [20]. Yoruba Language resources in digital form are not really available. Based on the help of Natural Language Processing (NLP), developers can arrange and organize way to execute works such as automatic speech, speech recognition, machine translation, named entity recognition, sentiment analysis, relationship extraction and topic segmentation [9]. The translation nowadays is characterized by using deep learning models.

Speech to speech translation needs to be carried out by translating source speech to source text, then source text to target text and target text to target speech (source speech to target speech). Natural Language Processing (NLP) is a branch of artificial intelligence that systems analyze, comprehend, and draw meaningful output from human language in an intelligent and usable manner.

Ubiquitous device is an electronic device capable of employing wireless, Internet, and other networking capabilities that are pervasively integrated in the environment and may be utilized practically anywhere and at any time [20]. Syntactic and semantic analysis are the primary methods used to accomplish the works of Natural Language Processing. Placement of texts in a sentence to ensure that they make grammatical sense is known as syntax. Syntactic analysis is used in natural language processing to ascertain how closely a natural language conforms to grammatical norms. Grammar rules are applied to words using certain algorithms, which then extract the meaning of the words. Additionally, syntax contains a few specialized methods: Part-of-speech tagging, Stemming, Lemmatization, Word segmentation, Parsing, Sentence breaking, Morphological segmentation. Semantics refers to the linguistic and logical elements conveyed by a text. Semantic analysis is one of the most complicated areas of NLP. In semantics, computer algorithms are used to determine how words are understood and how sentences are put together: Word sense disambiguation, Natural language generation, Named entity recognition (NER).

II. REVIEW OF SPEECH BASED TRANSLATIONS

[7] addressed improving English Arabic translation using the transformer model with multi-head attention. It combines a multi-head attention mechanism with a feed-forward network. It showed how effective it was in improving translation by obtaining a BLEU score of 99.5, an astounding accuracy of 97.68%, and a loss of 0.0778 but there were low-data resource languages, handling rare words, domain adaptation, model robustness. scarcity of reference translations and human annotators. [25] worked on natural language interface for automated generation of data flow diagrams using web extraction skill in order to create a Natural Language Interface (NLI) that helps users to create queries and determine the system strength and restrictions for the creation of DFD. The keywords were extracted from primary data with Natural Language Processing (NLP) techniques, which also helped to create a data repository. Additionally, rule-based algorithms were utilized to map user questions onto the proper token shapes in order to draw the necessary functionality into the appropriate DFD levels. Empirical results demonstrated that the DFDs produced by the system were accurate, comprehensive, and noteworthy. Extensive experimental research with applications incorporating extra variables such as time and cost effectiveness were disregarded. [18] researched on data augmentation techniques in Natural Language Processing, which carried out an in-depth study of data augmentation (DA) techniques in Natural Language Processing (NLP), which assessed the system in a methodical and comparable manner. The review showed the essence of data augmentation tools in Natural Language Processing in present day. It only gave review of data augmentation techniques in Natural Language Processing.

[17] researched on ULearn English: An Open Ubiquitous System helping in Learning English Vocabulary to develop Ulearn English, an open-source system for ubiquitous English learning dwelled more on incidental vocabulary acquisition, which adopted design science research (DSR) as the research method, allowing the construction of a ubiquitous learning model for English vocabulary acquisition and demonstrated a positive reaction when accidental learning strategies were used in conjunction with the learner context, as indicated by the acceptance rates for utility, ease of use, user context assessment, and ubiquity. The sample size for the evaluation of the system is relatively small, with only 15 learners using the developed system and 10 participants answering the survey. [4] worked on development of a Prosodic Speech Syllabic Corpus of the Yoruba Language, research was the need to contribute to the limited resources for the Yoruba language, mined textual inputs from different sources consisting two Standard Yoruba (SY) fiction, an SY grammar. Syllables were used as the basic units in this study's use of the concatenate-synthesis-based unit selection method. In order to extract phonetically balanced text bags containing 7376 sentences and phrases with the goal of minimizing the extraction cost while optimizing phonetic coverage of all regular Yoruba syllabic occurrences, a combination of the Falaschi scheme and the add-on process of Radová and Vopálka were utilized.. In the work, low number of sentences and phrases were used, it could not cover wider area of the prosodic space. [13] explored on multilingual speech-to-speech translation system in mobile offline environment was accommodating diverse executions of Human Language Technology (HLT) apparatuses for language, which explores the design and architectural building blocks of the "Translator" speech-to-speech translation system, focusing on the coordination and cooperation of separate Human Language Technology (HLT) components, for coordination and cooperation of separate Human Language Technology (HLT) components, consisting of automatic speech recognition, machine translation and text-to-speech. focused on the design and architecture of the system.

[6] described ubiquitous, non-Intrusive text with sentence-level sign translation, using of sign translation, using sensors to get signs and automation technique to align the extracted signs to English. used hierarchical bidirectional deep recurrent neural network (HB-RNN) for single-sign word-level ASL translation, which is designed upon the bidirectional recurrent neural network (B-RNN) and Long Short-Term Memory (LSTM) models. The DeepASL, a deep learning-based sign language translation techniques that allows for the non-intrusive transformation of words and sentences into ASL. It aims to segment the communication difficulties between deaf people and the hearing majority. but the system can only handle few deep learning-based signs. [5] developed statistical machine transliteration system for translating of English and Nigerian languages, was to setup parallel corpora, train and experiment Nigeria Languages: English-to-Igbo, English-to-Yorùbá, and Igbo-to-Yorùbá, phrase-based statistical machine translation systems. This, during the course of this project, involved the creation of parallel corpora for language pair utilizing text from the religious corpus in order to train the systems. The English-to-Igbo, English-to-Yorùbá, and Igbo-to-Yorùbá MT systems recorded BLEU scores of 30.04, 29.01, and 18.72, respectively. Additionally, the preliminary results from phrase-based SMT systems for English-to-Igbo, English-to-Yorùbá, and Igbo-to-Yorùbá were also recorded, along with the results of error analysis carried out on the translation results from individual system. The work was the domain was only in religious area. It did not touch other areas of life. [20] developed ubiquitous mobile using speech based translating tool for Sesotho Language, which was to design a corpus that has English phoneme as the source and Sesotho as the target language. This was based on putting together of automatic speech recognition, machine translation and speech synthesis. Analysis tool was used for checking accuracy and searching rate of the corpus. In which a system

was developed to translate some words from English language to Sesotho Language, but it cannot recognize long speech, also words were limited to a certain domain, based on phone storage and processing incapabilities.

[16] worked on automatic speech recognition for low resources languages that was a general overview that concentrates on automatic speech recognition (ASR) for the language. Definition of low-resourced languages and the difficulties related to it were outlined. This study provides a literature overview on recent contributions to ASR for low-resourced languages, that was a useful beginning place for all interested in initiating work on operational development of ASR for one or multiple low-resourced languages, research work was the survey covered only Speech to Text. [9] article examines natural language processing in artificial intelligence with algorithms related to grammar for a foreign language. The results may serve as a foundation for future research in applied linguistics and theoretical language research, comparing native and foreign languages. The study utilized a Recurrent Neural Network (RNN) with attention to create phrase parse trees, demonstrating the effectiveness of general sequence-to-sequence techniques, may obtain good results on syntactic constituent parsing with relatively little work or tuning, providing a crucial technological asset and new development that would be valuable for both contents and semantic analysis of big datasets, Its outcomes could indicate tendencies of theoretical study in comparative form between local languages and foreign languages, the work was the new research may be needed to these approaches which might be considered only as a theoretical stucture that other users may not get the hypotheses to validate. [12] developed fuzzy Logic in Natural Language Processing, which was to have knowledge of fuzzy logic, an automated Intelligence technique for making decision to be effective and describes real world examples in the presence of this intelligence limit using common natural language processing packages which made use of application of fuzzy logic to improve the systems. The output analysis is very important for natural language processing systems including, Question Answering System, Machine Translation and information retrieval. Some translating techniques were used like the START were made at MIT for Questioning – Answering system, Google search engine and Google Machine Translation. The work only reviewed Fuzzy Logic in Natural Language Processing.

[1] developed a Yorúbà text to speech system with festival, the work was presentation of a text to speech (TTS) synthesis system for Yorúbà language with open-source Festival, TTS engine using Festival Speech Engine was created to only use ASCII codes as input. A preprocessor was created in python which takes in non ASCII codes and transforms them to ASCII codes that are not in the Yorúbà alphabets. The speech produced by the system shows the level of response and naturalness of the system on text-level are average respectively. The system performs below expectation to both intelligibility and naturalness examination on sentence level. Also, the measure of naturalness is low. [19] developed letting learning ubiquitous with mobile translating system using optical character recognition (OCR), the research was to develop a mobile translation package using optical character recognition (OCR) and to feedback from users for acceptance of the proposed mobile application, in this work, the main method that was used in the study was statistical machine translation technologies. Then maximize the use of noise suppression in distributed speech recognition to identify speech content. This study translates words into the preferred language of non-native speakers of Malay to aid in understanding. It is quite beneficial, particularly for gaining knowledge quickly. Only the original language can be translated into Arabic or English. The system does not support other languages. Each language used in the system needs to be configured first before usage. [11] in translation with a phrase based statistical machine translation system to re scoring the presentation of a joint multigram model. Research was to use a re-scoring technique to effect the models. Two translation systems that each is capable in its own right, the main method that was used in the study was joining of two methods to directly transliterate from text to text. Also, used two phases of-the-art techniques: phrase-based statistical machine translation (SMT) and joint multigram model. This helps to make no language actual options, used no dictionaries or explicit phonetic data; the method translates series of tokens in the source language directly into arrays of tokens in the target language, but There is need to check the use of enhance segmentation actions that do not depend on large probability training to solve the challenges inherent in this method. [21] used objective texts in the survey to enhance the colloquial Arabic sentiment Analysis, the research was to test the effect of using objective texts in joining with tender words on sentiment grouping for the colloquial Arabic reviews, mostly Jordanian colloquial reviews. Two lexicons were used; the colloquial sentimental texts and complex phrases, while the other holds the objective words related with values of sentiment tendency based on a particular estimation method. The lexicons were to get sentiment attributes that would be training input to the Support Vector Machines (SVM). but it was only for Arabic language. [10] developed a cross-platform ubiquitous language learning features via mobile phone and interactive television, which was to tackle issues related to cross-platform user template design and architecture for ubiquitous language learning, prototyped and displayed on both iTV and mobile phone interfaces, focusing on scaffolding hard language items, scaffolding overall knowledge, just-in-time scaffolding, and supervising personal learning curve. It addressed the challenges of cross-platform user template design and architecture for ubiquitous language learning. There were challenges in reading text and on-screen display mainly on the iTV side of the template. [27] worked on Construction of Course Ubiquitous Learning

Based on Network, the objective was bringing the new teaching practice and teaching reform into Ubiquitous learning will, which will result into an crucial way of learning in 21st century, used ubiquitous learning system in education, the design and optimization of an algorithm for data mining in the assessment of the ubiquitous learning system on translation courses. This addressed the enhancement of teaching and learning experiences through interactive discussions and translation but the system could not implement ubiquitous translation and learning system.

[3] developed a web-based English to Yorùbá machine translation system, the work was to improve on already existing works on Yorùbá language translation using rule-based approach with context free grammar (CFG) in which Web enabled platform for translating simple sentences from English to Yorùbá was designed. The work was based on only few words translation in the database. [8] developed English to Yorùbá machine translation system for Yorùbá verbs' tone changing, the work was to translate from English to Yorùbá with tone change monosyllabic verbs using machine translation systems with the system was designed with unified modelling language (UML). The Rule-based method was used for the translating. Python programming language was used for the system development. The python has natural language tool kits that are used for the sentence parsing using the theory and the system developed can conveniently address the problem of English to Yorùbá with Tone change monosyllabic verbs. The issue of serial verb was not addressed within the context of machine translation. [22] addressed ubiquitous mobile real time visual translator using augmented reality for Bahasa language. The objective of the research was simply to reaffirm on combining real time visual with augmented reality technology on mobiles for educational purpose. The design of the system was based on visual cognitive simulative software development life cycle methodology for augmented reality (V-CSSDLC-AR) for mobile augmented visual translation. A system performs by reading the text in Bahasa language and changes them to English language anywhere and anytime. The system was only simulated, it has not been fully implemented.

[26] implemented a text to speech application for Fon language using Multisyn algorithm, The objective of the research was to describe the setup of a unit selection speech synthesis system with Fon language for text-to-speech system. The use of phases of the system in Java programming language and the different sections of building a synthetic voice in Fon using Festival. The unit selection algorithm used was Multisyn. use of letter-to-sound rules, phonetic and post lexical rules for computational phonetic transformation of input text. Design of automatically generate artificial speech waveforms of a TTS synthesizer in a computer-based system that should be able to read any text aloud. There is a need to improve the LTS (Letter-To-Sound) rules, record the speech corpus in a good studio with a speaker, and manually segment and label the database. [14] implemented text to speech translation for blind, it converted processed text into synthesized speech representation of the text. Natural Language Processing (NLP) is used to process the text, followed by Digital Signal Processing (DSP) technology to change the processed text into a synthesized speech representation. Researcher designed an easy and cute graphical user interface which permits the user to type in his/her text in English provided in the text box in the package and it be transformed to speech. The limitation of the research work was it could process only English text and applications that are already online. [15] researched on speech-enabled hybrid multilingual translation for mobile devices in which the objective was on a general-purpose system that allows arbitrary input. A prototype for speech-to-speech translation on Android devices. The study was based on GF grammars, statistical disambiguation and chunking-based robustness, enhanced by Android's off-the-shelf speech input and output. The app is a front end to a grammatical language resource, it can also be used for other language-aware tasks such as learning application.

[2] proposed the implementation of Yoruba text-to-speech e-learning system, the research was presentation of text-to speech (TTS) system and to transform text into speech. In which The concatenation method was utilized to construct a TTS system employing syllables, and the basic unit of concatenation was written in C#. The speech produced by the system was the text-to speech which was high likewise the naturalness of the output but the research work was the pronunciation was not perfectly smoothened. [24] delivered language learning and transformation with ubiquitous system through statistical machine translation approach. It increased the translation quality by upgrading the translation table and preparing the Sanskrit text. The used of Statistical machine decoder, a translation framework. Also, integrating Statistical machine translator decoder, client/server configuration with the whole translation service on the mobile device. A thorough foundation for a ubiquitous translation and language learning premise using the strength of modern cell phone technology has been achieved. In the research, the network technologies will prevent deployment of the system into a vast network environment. [23] delivered English-to-Sanskrit statistical machine translation using ubiquitous system, the study aimed to enhance translation quality by improving the translation table and prepping Sanskrit language text with the Eclipse emulator and cross-compilation toolkit in conjunction with Java.

Android lacks several common desktop distribution features but offers support for touch screens, sliding keyboards, and a template to the camera, GPS, compass, and accelerometer. Creation of a general overview for language learning and translation that is widely used, namely for English to Sanskrit, on the development board Mini 2440 SBC, an expanding mobile phone operating system with internet access. There was no focus on audio input, the model was not fully implemented.

2.1 DISCUSSION

This paper delved into different aspects and modes of translation of the existing systems, the methodology, strength and weakness of the existing works are mainly divided into three phases which are: Speech to Text (Automatic Speech Recognition), Text to Text (Machine Translation) and Text to Speech (Speech Synthesis). Most of the works done are on one phase out of the three phases in ubiquitous based speech to speech translation process. It shows that there is need for collaboration among different researchers to develop speech to speech translation even with the using of ubiquitous devices.

In table 1; speech to text translation; [16] used hidden makov model. For text to text translation; [6], [7] used neural machine translation approach [24], [22], [19], [11], [21], [10], [18], [27], [5], [12] used statistical machine translation approach and Android for ubiquitous aspect. [3], [8], [25] used rule-based machine translation approach. For text to speech; [2] made use of concatenation method, [26], [4] used unit selection algorithm, [14] used Digital Signal Processing (DSP) technology, [1] used open-source Festival engine. Based on this there are few works on speech to text, more works on text to text and text to speech. There is need for more research to be carried out on speech to text.

Table 1: summary of some researches on speech based translations

Modes of Translation	**Methodology / Model**	**Numbers of Authors**
Speech to Text	Hidden Makov Model	1
Text to Text	Neural Machine Translation	2
	Statistical Machine Translation	10
	Rule-Based Machine Translation	3
Text to Speech	Concatenation Model	1
	Unit Selection Algorithm	2
	Digital Signal Processing (DSP)	1
	Open-Source Festival Engine	1

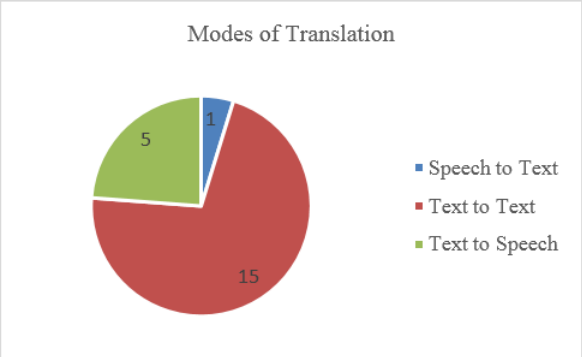

Figure 1: Modes of translation

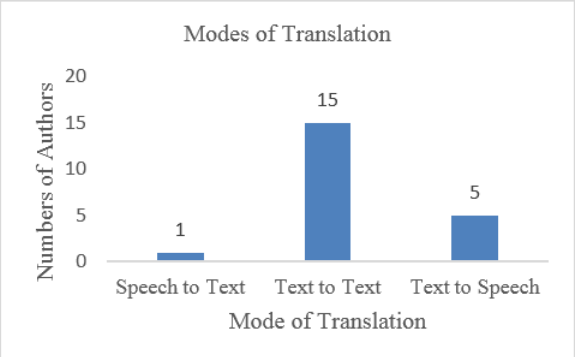

Figure 2: Modes of translation with number of Authors

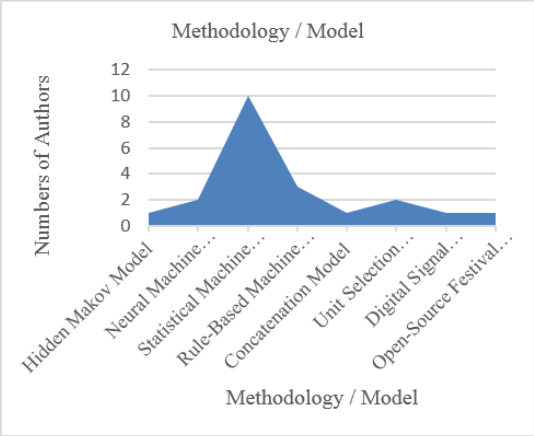

Figure 3: Different Methodologies / Models with number of authors

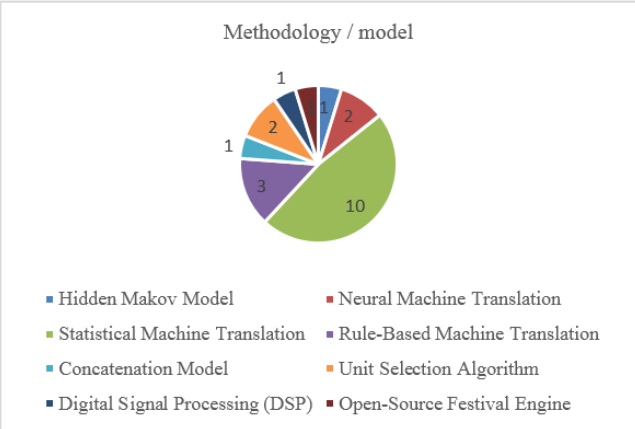

Figure 4: Different Methodologies / Models with number of authors

Figure 1 and figure 2 showed three modes of translation and the numbers of authors that worked on it. In which one author worked on speech to text, five on text to speech and fifteen on text to text translations. Also, Figure 3 and figure 4 show different methodologies or models used for translation; one used hidden makov model, two used neural machine translation, ten used statistical machine translation, three used rule-based machine translation, one used concatenation model, two used unit selection algorithm, one used digital signal processing and one used open-source festival. Engine. Each mode of translation is necessary for speech based translation for language learners.

III. CONCLUSION

The review shows the extent of works on ubiquitous speech based translator for language learners. There are three major different phases in ubiquitous speech to speech translating system with their translating approaches: Speech to text, Text to text and Speech to speech. Each phase can work independently if it is used singly. Each phase needs to rely on one another if it will work as a single system. Also, it will also help users learning Yoruba characters, words, sentences and translation of English to Yoruba.

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