An android based language translator application

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Abstract. A mobile translator is a mobile application that can be utilised for translating from English to any other dialect, and vice versa. The problem of language difference has hindered effective information communication over the years. There have been difficulties in information communication amid countries over the years. In modern times, language interpreters must understand and speak both the language been translated to and verse-visa. This traditional approach used for solving the problem of language differences has not been productive and favourable. Also, the teaching of different languages can be difficult due to language difference problems. The individual will also have to be taught by a tutor who will incur extra expenses and may not be the most efficient and favourable method. Therefore, the study develops an android phone language converter app in order to make learning and language translation easy and facilitates stress-free communication. The proposed language translation uses Google's real-time translation API natural language processing with Java programming language to develop the application. The most used languages globally (i.e., English, Spanish, Arabic, Hindi, French, and Chinese) were used for the android application translation. This application can be useful for Tourists for communication purposes, thus allowing them to integrate with the local people and access the right information. The system will also be able to evaluate language translation to determine their suitability for everyday conversation; given the fact that it is an android application, one will always be willing to use their phone to learn, compared to having them on a computer or learn from a physical tutor when your phone can be your tutor. The application was evaluated based on the classification time the memory usage, and the battery life all through distinctive use.
1. Introduction
Because of the increasing utilisation of mobile gadgets, the idea of mobile and omnipresent computation is becoming an extremely significant aspect of our daily lives due to its rising processing power, vast storage capacity, simple user experience, and enhanced network infrastructure. There is an increasing request for mobile utilisation to sustain our day-to-day events and offer diverse amusement [1]. Android is probably the most popular operating system that millions of smartphones and tablets are using today [2, 3], and is increasing by leaps and bounds. Hence, the android phone is one of the most advanced and easiest-to-use tools [4, 5, 6].

For the modern implementation of the education system, translation and language learning tools are needed. Often there is a boundary to the functionality and functions of current online submissions and a substantial increase in the number of cell phone apps providing such services. Machine Translation (MT) is an automated transformation of one natural language into another employing computer [7, 8, 9]. Arithmetical Machine Translation is a method to MT that is categorised by the utilisation of machine learning approaches [10, 11].

There are nearly 6,500 spoken languages globally, and 4,500 of them have more than 1000 speakers [12]. In information communication, language has been a significant barrier for centuries now, and human beings have always tried to provide a solution to the issues of language translation. Over the decade's humans have developed different ways of translating languages in other to solve the problems associated with language differences. The first approach which was implemented in solving this language problem was by using human translators that will be able to understand and translate both languages to the involved parties. This method was the first method introduced and has been used for decades, which has proven not to be the most efficient and effective method of language translation proven over the years. This method involves the translator being able to comprehend and express the language being translated and also understand and talk about the language of the party in which the language is going to be traduced. Translation of languages is useful in many aspects, such as education. It is challenging to teach in a specific language if the people being led do not understand the language of the tutor. For the students to have a complete understanding of what they are being taught, an interpreter will be needed. In tourism, tourists may not be able to communicate with people successfully in the tourist country he visited, thus hindering communication.

In communicating in general language, differences could lead to hindrance inaccurate dissemination of information [13, 14, 15]. In politics, language understanding is an essential factor in some countries like Nigeria, which has about 520 languages spoken in Nigeria, caused by multiple ethnicities [16, 17]. Therefore, each representative must be able to communicate successfully in other to share their ethnic view. In entertainment, language understanding is another significant factor because, for viewers to understand any content concerning entertainment, the viewers must also understand the scope of language in many other sectors. Language is a significant factor in communication, without which it is impossible to accomplish meaningful results [18, 19]. For these reasons, the language translation is significant in Society at large irrespective of the sector. Hence, it is of importance to find a different approach other than standard human language translation by uses a mobile phone, computer, or machine translation, which forces on translating the major languages spoken across the world. Therefore, the paper has chosen Android as a platform to develop an android-based language translation application that solves the significant languages commonly spoken around the world. The android-based system provides a solution for people who can't read a language because they don't share a common language, or for other purposes. This paper applies an erudition procedure to the extraordinary form of the earlier interpreted language, identified as a comparable corpus, equivalent text, bi-text, or multi-text in various ways. This will help solve the limitation of human translation concerning cost, more extensive language translation options, and efficiency.

2. Survey of spoken languages
Language policy is Society's response to the plurality of languages. The world's languages are indeed varied and various, and their distribution is dynamic and unpredictable over the face of the globe. Six thousand one hundred seventy living languages, except dialects, have already been described [20, 21]. According to one of the newly reported inventories, all of these languages and their speakers are
located in one or more of the world's countries, vastly different in number, including 160 sovereign States. Although some of these systems holding more than one language is self-evident, hence distribution is far from fair. Many states have more languages than others, no matter how big they may be. One of the minority languages of neighbouring countries, regardless of the number of speakers, maybe the same language dominant in one Society. French and Spanish are minority languages in the United States, which lists millions of speakers [22]. The estimated number of minority languages spoken within all states' borders exceeds the number of languages worldwide [23, 24]. The distribution of languages in the world is not only diverse and complex but also unpredictable [25, 26]. This volatility is attributed to peoples' migration, which is partially a feature of travel access. When counted by several local speakers only, these are the most communicated dialects on the planet.

English is the utmost vocalised language in 2020, having 1,132 million speakers [27, 28]. This shows the beautiful accomplishment of English as the greatest extensively used dialectal of business, travel, and international relations. The relative straightforwardness with which the English language can become and the unavoidable delicate intensity of US culture implies that English will keep on ruling the world stage for years to come. For a few, English is as yet synonymous with circumstance and superior personal satisfaction. Mandarin Chinese has over 1,117 million speakers; the numbers generally differ [29]. Ethnologue puts the number of local speakers at 1.117 billion; approximately 917 million people communicate in Mandarin, yet there's no uncertainty it the most expressed language on the planet. Coincidentally, an individual wishes to become familiar with a language that one of every six individuals on the earth speaks; this is the one for you. There are around 615 million local Hindi speakers, making it the third most communicated language on the planet [30]. It's the official language of India and is likewise spoken in nations, for example, Nepal, Fiji, Mauritius, and Guyana. Spanish have 534 million speakers [30]. For the Spanish language, there's an impression of being the least demanding unknown dialect for English speakers to acquire. Specialists state it takes just 22-24 weeks to arrive at the concept called general proficient capability in the language [31]. French has 280 million speakers, spoken across several parts of the world [32]. As it had been thought, the remainder of France and parts of Canada to many African nations, including Senegal and Madagascar. The French language has spread its underlying foundations far and wide of the whole world.

2.1. Natural Language Processing

The processing of natural languages (NLP), a branch of machine learning, helps create efficient contact between computers and humans [60]. There have been significant breakthroughs in recent years in enabling computers to use human language to comprehend human languages [61]. The biggest issue is the overload of information, which presents a significant problem with obtaining a particular, relevant piece of data from large datasets. Due to consistency and usability challenges, semantic and meaning awareness is essential and difficult for summary systems. It is also necessary to describe the significance of the interaction between entities and objects, especially for the use of high-dimensional, heterogeneous, complex, and low-quality data, as is the case for other languages. The requests have to be converted into formal database queries like SQL, to retrieve information from RDBs for user requests in natural language. Moreover, in practice, NLP queries are complicated to convert into structured DB requests or service request URLs due to factors such as complex DB-Layouts with table names, columns, restrictions, etc., or the semantic discrepancy between user vocabulary and DB-Nomenclature as in the other languages aside english.

3. Computer translation

Computer Translation is a field of etymology that utilises programming to translate languages from one language to another [33, 34,35]. On a level, understandings are, in reality, candid. A dog is a dog in every language. In this method of translation, the computer can translate spoken words or written text or content via the utilisation of natural language processing. Translation by computer could only solve the books from one language into another [36]. It cannot do what a human translator can do, which is to take grammar, idioms, conventions, and, above all, the sense of the original language into consideration when translating it into the target language and preserving its meaning as close as possible to the original language [37, 38].
Machine Translation (MT) manages language impenetrability problems by automating natural language text or voice translation [39, 35]. MT programs, distinguished by human-like communication and free from humanoid interference, excel in providing judicious translation precision. MT programs have experienced many improvements since their development to measure people's demands of clear and correct translation. MT programs have undergone numerous changes since their action to measure up to people's needs for precise and accurate communication. The translation method has usually seen a significant shift in recent years, depending on a set of rules (rule-based or knowledge-based approach) to relying on data (corpus-based or evidence-driven approach) [40, 35]. However, the concept of using language-independent intermediate representation for translation seems to be intriguing (as in the case of Interlingua-based Machine Translation [41, 35], it is threatened by linguistic diversities and excludes their viability. They were using corpora to convert faces certain barriers but not all of them. Using corpora to interpret faces specific barriers but not all of them. Corporate-based MT programs, distinguished by the ability to self-learn, study on the fly from source to goal mappings. These frameworks eliminate the need to have linguistic knowledge and NLP methods directly involved. The availability of machine-readable text and the necessary hardware and promising translation efficiency are critical factors behind such translation techniques' wide-ranging evolution. Example-based machine translation (EBMT)[42], statistical machine translation (SMT), and neural machine translation (NMT) are broad categories of corporate-based MT, specified in the order in which they evolved. In terms of conditional probability questions, SMT reformulates the translation problem [43, 35]. SMT seeks target translation (T) that maximises dependent probability P(T) given the source sentence (S). In a nutshell Equation, 1 defines SMT.

\[ \hat{T} = \text{arg} \max_T \{P(S|T) \ast P(T)\} \]  

The language model (LM), referred to as P(T), the translation model (TM), referred to as P(S|T), and the decoder, referred to as arg max\_T, constitute critical SMT components that operate collaboratively to achieve optimal target translation, \( T \). TM creates a list of potential target words/phrases, reordered by LM to produce a syntactically correct target language sentence, given a new source language test sentence. Thus, TM, learned from the parallel corpus, is satisfactory, while LM, learned from the monolingual target language corpus, is fluent in translation. Eventually, the decoder uses a beam search strategy to explore the search space of possible re-orderings (translations) and to output the most probable translation. Nevertheless, while projected translation will be the most potential and optimal mathematically, it does not automatically have to be right from a linguistic perspective.

4. Review of related works
Olaide, Kayode, Sunday, and Olusola [44], came up with a paper Android Platform for Machine Translation - A Focus on Yorùbà Language. Which was developed on a mobile platform for easier accessibility, convenience, and portability? RST (Rough Set Theory) is the mathematical tool used in decision support and data analysis of words or phrases to be translated [45, 46]. Comparisons between a query that is, word or phrase to be solved, are made with the created corpus, using RST.

Hanuman, Debnath, Bhattacharjee, Tripathi, and Roy [47], suggested a Multilingual Voice Translator English Document Using Android; the paper aims to provide the design and development approach for an Android framework whose purpose is to provide a solution to address the language barrier by integrating text for translation to speech in different languages. The Android framework produced voice conversion software to enable the transformation of English language text through speech production in other languages. The work has suggested a few changes that could further expand this program to include more target audiences and make it more efficient and profitable. The new English Text to Multilingual Speech Translator using Android (T2MSTA) is designed to help people who lack the power to talk or non-native speakers and individuals who do not share a common dialectal.
Ahmed et al. [48] developed an Arabic Sign Language Translator, which can recognise Arabic Sign Language (ArSL) movements offers a hearing-impaired solution for easy integration into Society. This paper intends to establish a theoretical framework for a smart translator to understand the ArSL’s independent, fluid movements. The ArSL datasets were developed from scratch in the proposed system, together with utilising ArSL’s 100-sign vocabulary, the authors added 1500 video documents for those secret languages. Such secret languages were categorised into five styles of signals, distinguishing movements from elaborate gestures in a sign language could be a problematic issue for study. The investigational fallouts indicate that the device projected determines signals with an exactness of 95.8%.

Ramiah, Liong, and Jayabal Ramiah, Liong, and Jayabal [49] developed an Android application by mixing the Tesseract OCR engine, Bing translator, and phones' built-in dialogue. The proposed application deliverable is tested by various types of target end-user from a diverse dialectal contextual and settled that the utilisation aids several operators.

Lahoti, Kayal, Kumbhare, Suradkar, & Pawar [50] developed and introduced an Android-based framework that translates the American Sign Language to a text that can be used anywhere. The mobile camera shots the picture, and skin segmentation is achieved using YCbCr systems. Features are extracted from the image using HOG and list to recognise the symbol. Using the Support Vector Machine (SVM), the classification was completed.

Triyono et al. [51] published a study on Sign Language Translator Software Using OpenCV. This research focuses on designing a sign language translator software using the Android-based OpenCV framework; the colour discrepancy powers this technology. The author often uses Machine Learning in terms of predicting the target. Results of the research showed that it is possible to use the coordinates of the fingertip search methods to recognise a hand gesture to the conditions found in the open arms when calculating motion with the hand clenched using Hu Moments meaning search tool. Fingertip approaches that are more effective in gesture recognition with a higher success rate are 95 percent for distance variance between 35 cm and 55 cm and light strength variants between roughly 90 lux and 100 lux and light green context actual state relative to the Hu Moments approach with the same parameters and the success rate of 40%.

Evelyn, Bennett, and Taylor [52] developed an English to Igbo Language Translation Natural Language Processing System in Android. The Design Word, Reference System, and Decoder were performed in Microsoft Hub; training similar documents and the language translation system was implemented in the Android studio environment and accessed through Android applications in smartphones. English and Igbo language tokens were determined using Finite State Automata; transition in each state identified the valid pass and invalid. Valid passes were found where change produces letters; invalid tickets occur when a difference makes a combination of digit and letter. English and Igbo language semantic were determined using attribute grammar, which was further expressed in a parse tree showing the syntax structure. The result shows one to one and one to many mappings of English to Igbo words/phrases.

Hakkun and Baharuddin [53] developed an Android-based program that could precisely translate the sign language transmitted in written language by deaf voice. The conversion process starts with the OpenCV hand recognition and the conversion of the K-NN classification hand signals. In this program, the demonstration functions were introduced to teach users intensively the use of sign language.

For the Arabic-English translators UjiKompetensiPenerjemah Arab-Indonesia (UKOPAI), Hidayatullah and Fahrizal [54] developed an Android competency test. This research employed a quiz model for advancement. The study solitary utilised manifold choice questionnaire procedures from the five categories of quizzes (multiple-choice, true/false, matching chart, completion test, and fill in the blank). This research input data instruments in the form of constituents and issues from a competency test based on the book: Tadribat Tarjamah (2012) and other texts interpreted as different options with another translation decoy.

Agarwal, Deotare, Tilekar, and Mortale [55] developed an Android application which allows contact between the deaf and the dumb. An ordinary individual who does not comprehend the language of signals. The software is a half-duplex style communicator that offers an effective mediator
to convert the deaf and dumb individual's hand signals into an audio medium, which an ordinary individual can willingly comprehend and vice versa.

Ambar et al. [56] came up with a study named A Dual-Sensor Powered Sign Language Translation System is an experimental concept. The technology was designed in a glove-based system that used two (2) categories of radars, an accelerometer, and five (5) elements of flex radars, to interpret the motions of each finger and neck. This article defines the configuration of the emblem language interpreter dependent on the gloves. The first experimental results subsequently demonstrate how useful the accelerometer and flex sensors are.

There exist a lot of works on local languages [57-59] however less efforts for development of android based language translator specially for African languages. This became motivation for us for this present work.

5. Methodology
The proposed Android Text translation is based on a double objective: (i) Word Transmission and (ii) Script Transfer Mark. For a mobile translator, text libraries of different languages were built using MATLAB, which includes the most frequently used terms in conversations in daily life. The user is asked to enter the text in the android code and click on the language-named button to convert to the text production. Figure 1 demonstrates the system architecture of the mobile translator. This is showed how the system proposed will function.

![System Architecture](image)

**Figure 1.** System architecture
In developing this android application which can translate the most used languages in the world (i.e., English, Spanish, French, Hindi, Arabic, and Chinese) to any selected languages, the android application will be using the IBM Waston Language translator, an API that uses machine learning and AI. IBM Waston employs rule-based AI and a broad range of other mechanisms (e.g., information retrieval systems) and the latest Neural network AI [60]. In Theory, the application was created using Apache Cordova and Node.js application platform operating on IBM Cloud Kubernetes software that uses Tesseract OCR to identify text in pictures, Watson Language Converter to interpret the approved text, and Watson Natural Language Comprehension to extract sentiment, the meaning of the book.

5.1. Proposed system
The proposed system is displayed in figure 1 and 2. Figure 2 demonstrates the developed system flow and functionalities. The flow is discussed outlined below as follows:

1. The user connects with the mobile app and takes a screenshot or selects a shot from the file.
2. The picture is forwarded to the framework Node.js server operating on IBM Cloud Kubernetes infrastructure that uses Tesseract OCR to identify text in an image.
3. Node.js app uses the Watson language-translation tool to interpret the accepted text and Watson Natural Language Comprehension to return the interpreted text's feeling & emotion.
4. Recognised text, language converted, feeling, and emotion tests are returned to the mobile app for view.

As shown in figure 3, the Development Structure is divided into two sections, the user and the public cloud section. The user section contains the user and the mobile application which the user
interacts with. The Public cloud session includes the cloud server, which uses IBM cloud infrastructure. It's connected to the Waston language translator service and Waston natural language understanding service, which are all IBM services that run concurrently. These services run in an IBM Kubernetes cluster.

Figure 3. Development structure

6. Implementation and evaluation

Figure 4. Snap and translate UI launched
Figure 5. Snap and translate first options.

Figure 6. Snap and translate image taking
Figure 7. The application UI translating from text to text

Figure 4 above shows the android application when the user launches it. Figure 5 shows the UI for the android application where the user selects the language to translate. Figure 6 above shows the UI for the android application when took a picture. Figure 7 shows the application of UI translation from one text to another. This particular one translated from French to the English language.

6.1. System evaluation

The application was tested for accuracy, translation time, and memory usage. The application maintained 99% accuracy when it was used to translate from one language to another. The translation time of the android smartphone achieved excellent time, the application was able to translate from one language to another within 47s, and for image translation, it was 1.25ms. This was achieved because of the Java scripts used. The memory used by the application was 15.6MB. This a deficient number and well within the limits of the android smartphone when compared with other applications on the mobile phone. By averaging the gradient for each data point and determining the overall average slope, the battery would hit 0 percent for the Android phone in about 10h46 m and 5h26 m for the S3. Android has higher energy consumption mostly attributable to its bigger screen and higher context processes.

7. Conclusion

Smartphones are recognised in real life today as the most widely used mobile devices. Since smartphone-integrated hardware can perform far more functions than conventional phones, smartphones are no longer just a contact unit, but rather a powerful computer unit capable of taking images, recording videos, browsing the internet, etc. With the growth of technologies, such tools can be used to perform text identification and conversion. The developed application can translate from a text to text language and image to text translation on the most used languages in the world (i.e., English, Spanish, French, Hindi, Arabic, and Chinese) to any selected languages. The application can be used to take pictures of road sins that contain text and converted text on the photographs form a foreign language into the language of the users' choice. The application performs the translation within 47 seconds and 1.25 minutes for an image to text translation, which is relatively fast, the memory used is deficient compared with other application on android phone. The accuracy of the translation of the application is also very encouraging, with 99% accuracy. Due to a larger screen and a higher number of background processes, the application energy consumption is still deficient compared to other applications on the phone. For further research, the application should include text to speech, speech to text, and even speech to speech translation, which will help visually impaired people.
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