TEXT TO SPEECH CONVERSION IN PUNJABI

Dissertation submitted in fulfilment of the requirements for the Degree of

MASTER OF TECHNOLOGY

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By

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PAC FORM

ABSTRACT

Speech is the most important form of communication in everyday life. However, the dependence of human computer interaction on written text and images makes the use of computers impossible for visually and physically impaired and illiterate masses. Text-to-speech synthesis (TTS) helps speech processing researchers to act upon this problem by synthesizing speech (in local languages e.g. Tamil, Hindi, Punjabi etc.) from written text like in browsers, mobile phones etc. A Text to Speech (TTS) system is a computer system that converts text into speech, i.e. read the text automatically when asked to do so. This system is a combination of both hardware and software. Generally a Text (Sentence) is composed of collection of words, while words are combination of alphabets arranged in a meaningful way. In this research work, Punjabi text is converted into speech by using nourish forwarding algorithm. The output of research work in the form of sound waveform and accuracy is more compare to previous implementation of TTS system [1].

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DECLARATION STATEMENT

I hereby declare that the research work reported in the dissertation entitled "TEXT TO SPEECH CONVERSION IN PUNJABI" in partial fulfilment of the requirement for the award of Degree for Master of Technology in Computer Science and Engineering at Lovely Professional University, Phagwara, Punjab is an authentic work carried out under supervision of my research supervisor Mr. Mamoon Rashid. I have not submitted this work elsewhere for any degree or diploma.

I understand that the work presented herewith is in direct compliance with Lovely Professional University's Policy on plagiarism, intellectual property rights, and highest standards of moral and ethical conduct. Therefore, to the best of my knowledge, the content of this dissertation represents authentic and honest research effort conducted, in its entirety, by me. I am fully responsible for the contents of my dissertation work.

Signature of Candidate
Priya

SUPERVISOR'S CERTIFICATE

This is to certify that the work reported in the M.Tech Dissertation entitled "**TEXT TO SPEECH CONVERSION IN PUNJABI**", submitted by **Priya** at **Lovely Professional University, Phagwara, India** is a bonafide record of her original work carried out under my supervision. This work has not been submitted elsewhere for any other degree.

Signature of Supervisor

Mamoon Rashid

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Counter Signed by:

1) **Concerned HOD:**

HoD's Signature: _____

HoD Name: _____

Date: _____

2) **Neutral Examiners:**

External Examiner

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Affiliation: _____

Date: _____

Internal Examiner

Signature: _____

Name: _____

Date: _____

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Priya

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CHAPTER 1
INTRODUCTION

In the field of sciences, machines are used to perform various computational tasks. Such as machine learning, optical scheduling in cloud computing, transaction and bio-inspired systems. Now a machine needs to take input from human or environment in order to perform its task. Old machines involved Command Line Interfaces which were a good start towards development of computational technologies, but due to the user unfriendly environment, Graphical User Interfaces came into the picture [1]. Though in script Shahmukhi in Pakistani Punjab. Punjabi is a language of syllables, hence waveform output is produced by linking the sounds of phoneme set apart in document of sound recorded. Phoneme sounds in various settings have been checked and put away in the database of speech to get normal sounding combined speech [5].

GUI's are successfully deployed in various web based systems as well as desktop applications. But the exponentially rising technologies has arisen a need to develop systems which are even friendlier than GUI's.

These kind of system may take input from the user surrounding environment and process it in an intelligent way. A branch of computer science called artificial intelligence deals with the designing and development of such intelligent systems in which intelligence is exhibited by machines or software.

Such systems are called artificially intelligent systems, they have the capability to mimic the behavior of humans. With these systems, human users feel like they are actually working with machines like with other human beings.

Various researchers from the field of Artificial Intelligence and Natural Language Processing have made lots of efforts to realize systems that are helpful in the accomplishment of same. Natural Language Processing has helped a lot to improve the human and machine interaction.

As with the change of time, usage of machinery in human life has increased in machines capable to understand the spoken form of language rather than written form. Therefore, our researchers doing their best to make the speaking task easy in human life through machines.

Over a period of time our researchers have invented many techniques to interchange text to speech.

- Text to Speech conversion system help to convert a given text into human speech language. This is also termed as speech synthesis.
- Speech to Text conversion systems help to convert given speech into text. This process is known as speech recognition.

This resulted in the invention of advance systems which are able to generate real natural speech. Such applications have also helped in the education and development of physically challenged people Example, blind people, many difficulties to read from monitor the things, similarly deaf people can't hear the speech [3]. So, such system play an important role in enormous areas [1].

1.1 NATURAL LANGUAGE PROCESSING

NLP (Natural Language Processing) is the most straightforwardly science related to handling human (natural) language. It gets from the computer science field since PCs, or some other units of handling, are the objective gadgets utilized to finish such preparing. This portrayal reacts essentially to the "Preparing" constituent part in NLP. What makes NLP unique in relation to any other preparing related action is the field of use: the languages of human. They manage more information related perspectives in this way necessitating the backing of abilities of learning by the content processors. Finally, it could be communicated that majority of the mechanized tasks which are of NLP and also related to NLP could be enclosed by the more broad idea of Machine Learning, plainly identified with computer science, which thinks about any subject identifying with the utilization of PCs for the surmising of the significant elements of the frameworks of examination. Since the specific field of analysis is natural language, these specific techniques of learning are of imperative premium, in light of the fact that somehow, we people make utilization of this sort of language as our fundamental method of reasoning and communication, intrinsically. In the event that generally a language which is formal was to be concentrated on (e.g., a programming language), there would be no motivation to make utilization of such approaches of learning in light of the fact that the issues of logic and construction destined to the formalism of that kind of language would as of now be predefined or known.

Regular use of complete NLP at high level would bargain exclusively with text information (at the system's input and output) for example, machine translation, question answering, text summarization or text classification. At the point when the technologies of speech and also other domains ought to be considered, regardless of

NLP strategies allude solely to the textual synthesis or analysis of the applications. Either ASR (Automatic Speech Recognition) or TTS (Text to Speech) synthesis need a trustful module of NLP since content information dependably shows up some place in the handling chain. TTS creates an utterances of speech from an input content whereas ASR delivers such content from an utterance of speech which is given as an input. These all are shown in Figure 1.1.
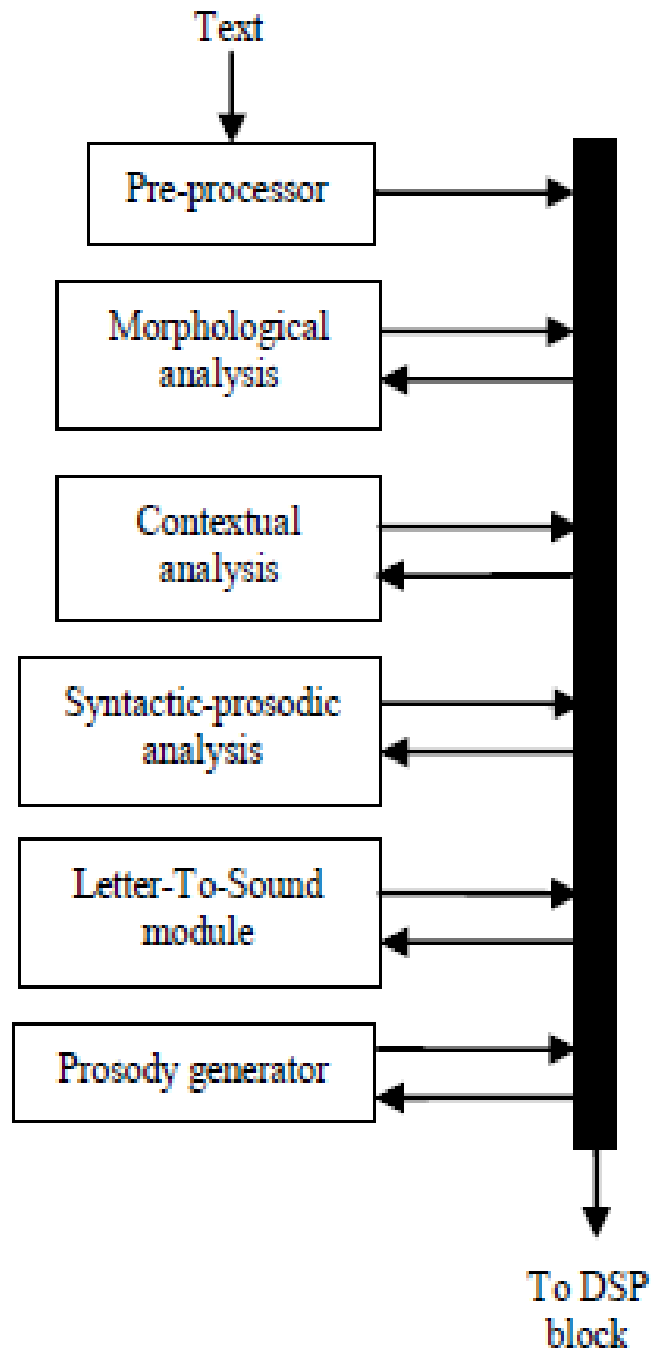
Figure 1.1: Block diagram of Natural Language Processing module.

Table 1-1 Major tasks involve in NLP

S.no	Tasks	Descriptions
1	Automatic Text Summarization [5], [6]	It gives a readable summary of a chunk of text. It is also used to give summaries of text such as articles in the financial section of newspaper.
2	Machine Translation [8]	It can do automatically text translation from one human language to another.
3	Named entity recognition [9], [10]	This given helps to determine which items in the text map to proper name and what is the type of each name (such as person, location).
4	Natural language generation [11]	It is a type of conversion that can convert the information from computer database into human readable language.
5	Natural language understanding [12]	It involves the identification of the intended semantic from the multiple possible semantics which can derived from natural language expression which usually takes from of NLP concepts.
6	Optical character recognition [13]	These system take as an input image representing printed text and determine the corresponding text.
7	Part of speech tagging [14]	In this task, machine determine the part of speech for each word for a given sentence. Many words, common ones, can serve as multiple parts of speech.

8	Relationship extraction [15]	Such system can identify the relationship among named entities in a given chunk of text.
9	Sentence breaking [16]	It is also known as sentence boundary .This has given a text in which it can be find the sentence boundaries and marked by punctuation marks.
10	Speech recognition [1], [17]	Speech recognition (SR) is the convertor of spoken words into text. That is also known as "computer speech recognition.
11	Speech segmentation [18]	It can do a subtask of speech recognition and typically grouped with it .Like it has given any person or people speaking .now in speech segmentation can separate it into words.
12	Question Answering [19]	This task can be used for a human language questions that determine its answer. Typically question have a specific right answer.
13	Morphological segmentation [22]	It can be used to separate words into each or single morpheme and identify the class of the morphemes.

1.2 SPEECH TECHNOLOGY

 The speech technology has some guidelines that aim for guiding decisions. It is also helpful for criteria regarding designing interface operated by human voice. Speech technology guideline has some advantages for saving cost and consistent services.

Some examples are know your callers, use simple and natural dialogue, be consistent etc. [1].

Many groups can be focused on voice and multimodal technologies. In this their use for advanced services that enhance the experience and capabilities offered to mobile user and enterprises the groups [3] .

Expertise covers a wide spectrum of technologies for expressive. Speech synthesis, speech based emotion detection and multimodal biometric. All the main speech technology are shown as Figure 1.2.
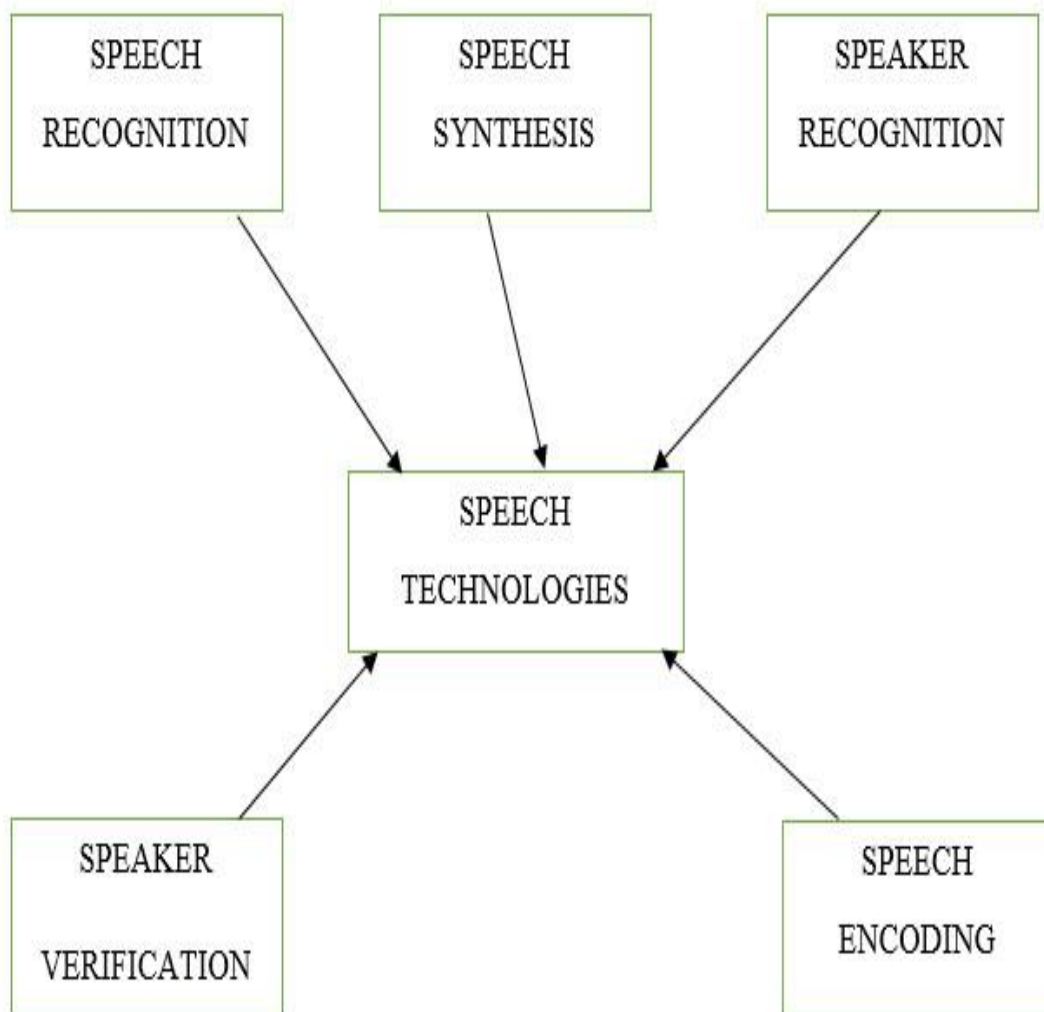

Figure 1.2: Various technologies of speech

1.3 SPEECH RECOGNITION

Speech recognition (SR) is the convertor of spoken words into text. That is also known as "computer speech recognition" [17].

Few SR systems have "speaker independent speech recognition". In this the one person that can have a specific voice is analyzed by system that can give an accurate result ,tunes the recognition of that persons speech .that system known as "speech independent" and that system has also no need of any training [1].

The SR is also a sub area of the computational linguistic that can be incorporates knowledge and research in computer science and electrical engineering area to develop the methodologies that enable to conversion of spoken language into text by computers [2]. Example smart technologies and robotics.

Some applications includes in speech recognition is that finding consensus in it and also word error minimization.it has also a tutorial on hidden markov models and selected in speech recognition [17]. A real time lip tracking for audio visual speech recognition.

SR also applicable for voice user interface such as voice dialing for example "Call Shubham", search a podcast like to search audio where particular words were spoken [17] .

The goal of speech recognition system is to convert a speech data into a text data of the device. Automatic speech recognition system may be see work in different four steps that is preprocessing, feature extraction, modeling and testing [23].

ASR system make use of NLP techniques in this ways that is based on grammar. Grammar is also a set of rules that we can used in text written in a given language by define its syntax. Now the context free grammars is play an important role [4]. That is also capable to represent the syntax of language while being efficient at the analysis of the sentences.

NLP techniques are of use in ASR when modeling the language or domain of interaction in question [4]. By the correct set of protocols for the grammar, and structures for the languages can be defined.

1.4 SPEECH SYNTHESIS

Speech is the most imperative type of correspondence in regular life. In any case, the reliance of human PC cooperation on images and written text makes the utilization of PCs inconceivable for illiterate masses and physically and visually impaired people.

TTS (Text-to-speech synthesis) helps researchers of speech processing to follow up on this issue by synthesizing speech (in languages local e.g. Punjabi, Hindi, Tamil and so forth.) from written content as in mobile phones, browsers and so forth. The synthesis of speech can be done by basically three techniques: Articulatory synthesis, concatenate synthesis and Formant synthesis.

Articulatory synthesis tries to display the system of production of human speech (particularly vocal tract framework, different articulators' viz. jaw, tongue, lip and so on.) and articulatory procedures straightforwardly. In any case, it is additionally the most troublesome technique to actualize because of absence of information of the complex organs of articulation of human.

Concatenate speech synthesis systems can synthesize sound speech which is more natural and high quality however keeping in mind the end goal for synthesizing speech with different characteristics of voice, for example, emotions, styles of speaker, individualities of speaker and so on., a lot of memory and corpus of speech is required as put away essential units of speech (like diphones, syllables and so forth.) are connected to shape sequence of word utilizing dictionary of pronunciation.

Formant synthesis depends on the guidelines which portray the thunderous frequencies of the vocal tract. The formant strategy utilizes the source-channel model of production of speech, where speech is displayed by parameters of the filter model. The formant synthesis which is rule-based can deliver quality speech which sounds unnatural, as it is hard to assess the model of vocal tract and parameters of source. [6]

Research in T-T-S is a filed which is multi-disciplinary: from acoustic phonetics (production and perception of speech) over morphology (pronunciation) and syntax (parts of speech, grammar), to processing of speech signal (synthesis). There are numerous stages of processing in T-T-S system: the text front –end analyses and standardizes the text which is incoming, makes conceivable pronunciations for every word in context, and produces prosody (intonation, rhythm, melody, emotions) of the sentence to be spoken. For T-T-S systems evaluation, three parameters need to be assessed: naturalness, intelligibility and accuracy [7]. The formatting synthesis which is rule-based.
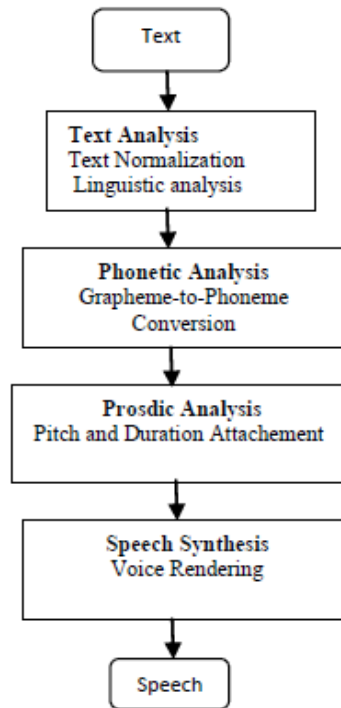
Figure 1.3: Block diagram of TTS

The procedure of transformation of text into speech extensively contains two phases:

1. Text analysis

2. Generation of signal of speech.

Text analysis comprises of standardization of the content wherein the symbols and numbers get to be abbreviations and words are supplanted by their entire words or expressions and so forth. The most difficult undertaking in the block of analysis of text is the linguistic analysis which implies syntactic and semantic examination and goes for comprehension the connection of the content. The factual techniques are utilized to locate the most plausible importance of the expressions. This is critical in light of the fact that the word pronunciation may rely on upon its importance and on the setting. And that is the main phase of the TTS shown in Figure 1.3.

Phonetic Analysis changes over the orthographical symbols into phonological ones by utilizing an alphabet which is phonetic one. For e.g. the alphabet of the International Phonetic Association contains symbols of phoneme, their marks which are diacritical and different symbols associated to their pronunciation, other alphabets which are

phonetic, for example, SAMPA (Speech Assesment Methods-Phonetic Alphabet), Arpabet and Worldbetare accessible.

Prosody is an idea which contains the speech rhythm, intonation and patterns of speech. At the perceptual level, instinctive nature in speech is credited to specific properties of the signal of speech identified with discernable changes in syllabic length, loudness and pitch by and large known as prosody. Acoustically, these progressions relate to the varieties in the basic frequency (F0), duration and amplitude of units of speech.

Speech Synthesis block at long last produces the signal of speech. This can be accomplished either taking into account parametric representation, in which realizations of phoneme are delivered by machine, or by choosing units of speech from a database. The subsequent short speech units are together joined to create the final signal of speech [7].

The main work of speech synthesis is that to provide the spoken output to the user by converting speech from text [1] .Thus it can read out the textual contents from the screen. Speech recognizer has ability to understand the spoken words and interchange it into text. So, that interchange the spoken words into corresponding text output.

Thus that can be used in the spoken dialog systems and it is also applicable for blind person, eyes and hands free applications [24].

Speech synthesis is used to convert text to speech. Now content to discourse framework procedures are unique in relation to live human discourse generation [5]. A human being speech production can depends of large fluid mechanics dependent on changes in lung pressure r vocal tract constrictions.

The working of the TTS framework is to exchange a discretionary content to a talked waveform. This movement do in two stages i.e., content handling and discourse era [25]. A content preparing can exchange the given content into an arrangement of combination units, while discourse era is era of an acoustic waveform comparing to each of these units in the succession.

Punjabi language

It is written from left to proper using Gurumukhi (an abugida derived from the Laṇḍā script and ultimately descended from Brahmi script) as well as Shahmukhi (a version of the Arabic script) scripts. This TTS gadget for Punjabi language has been developed

for Gurumukhi script. In Gurumukhi script, which follows the "one sound-one image" principle, the Punjabi language has thirty 8 consonants, ten non-nasal vowels and identical numbers of nasal vowels. All vowels and consonants shown in Figure 1.4.
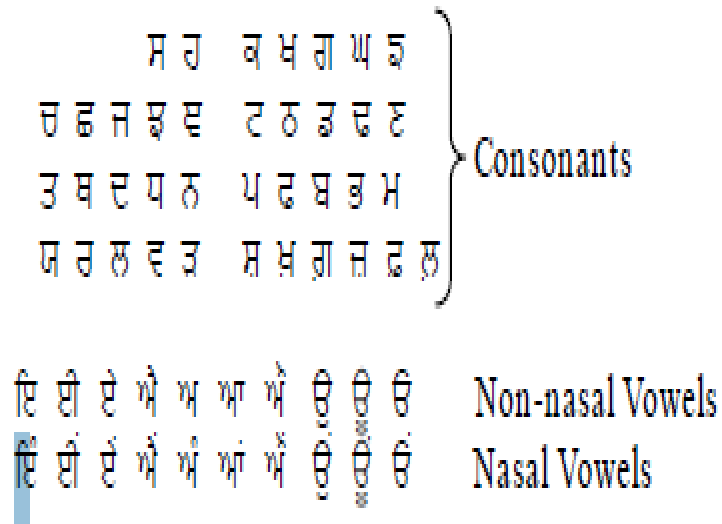
Figure 1.4: Consonants and Vowels

1.4.1 Components of a Text to Speech Synthesis

A front end is high-level synthesis phase that receives the text as input and outputs a symbolic linguistic representation [1]. That shown in Figure 2.1.

A back end is low-level synthesis phase that receives input in the form of symbolic linguistic representation and gives the synthesized speech in a waveform as output.
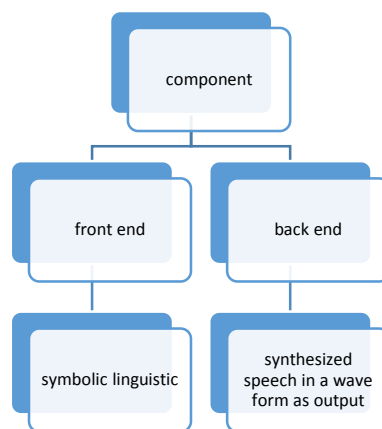

Figure 2.1: Component of text to speech

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1.4.2 Quality of a TTS Synthesizer

Commonly, two quality criteria are proposed for deciding the quality of a TTS synthesizer.
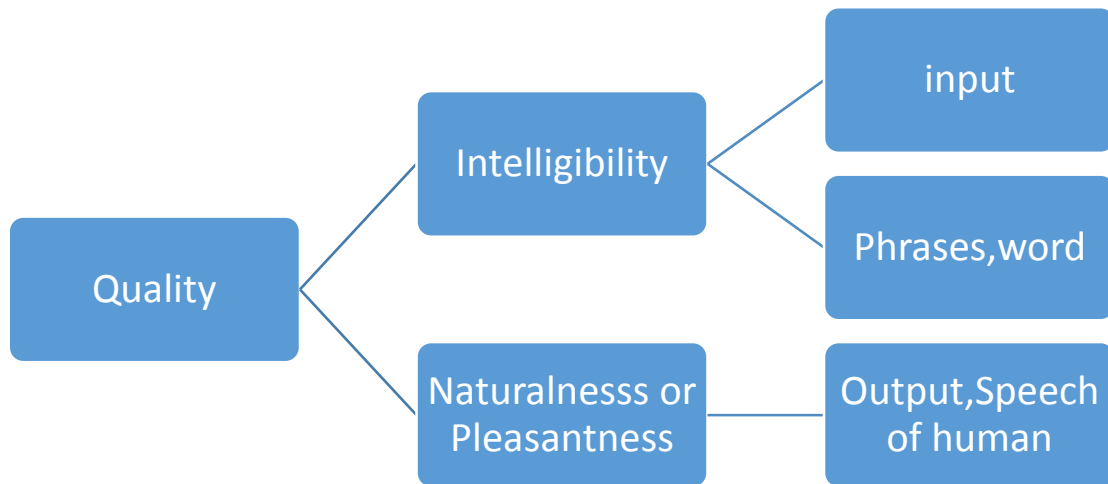
Figure 2.2: Quality of TTS synthesis

Expectation might be related to the idea of authenticity [1]. Thus, listening to an engineered voice ought to essentially permit the audience to ascribe this voice to some pseudo-speaker and to understand some sort of expressivities furthermore some records separate the talking style and the particular circumstance of statement. For this objective, the relating additional semantic data basically is provided to synthesize. A large portion of the current content to discourse synthesizers are more worried going to deliver a standard level of understandability with the expectation measurement [3], the steadiness to control expressions; discourse style and pseudo-speaker/not honest to goodness personality are still now the zones of concern and need changes. Notwithstanding, users" intrigues shift to a substantial degree as per the field of use: overall population applications for instance telephonic data recovery require maximal authenticity and expectation, while a few applications including experts (process or

vehicle control) or profoundly energetic people (outwardly debilitated, applications in disagreeable situations) request comprehensibility with the most noteworthy need [2]. That shown in Figure 2.2.

1.4.3 Application of Speech Synthesis

The field of application of TTS is quickly growing whilst the nature of systems of TTS is likewise steadily increasing. The systems of Speech synthesis are additionally turning out to be more moderate for common clients, which make these systems more appropriate for use in everyday life.

A few uses of TTS are:

- Aid to handicapped
- Talking toys and books
- Education and Games
- Multimedia and Telecommunication
- Man-machine communication
- An email which is voice enabled

1.5 CHALLENGS IN TEXT TO SEECH SYSTEM

Discourse union has been relentlessly made over the late decades and it has been joined into a various new applications. Making arrangement of discourse blend is a frustrated strategy and, it consolidates the going with basic challenges.

- Advancement of TTS frameworks necessitate information about creation of human discourse and about dialects which are being delivered.
- The real implementation of a complete functional system needs good skills of software.
- Majority of systems of TTS try not to produce semantic representations of their information content, subsequently, different heuristic techniques are utilized to figure the correct approach for disambiguating homographs, such as looking at neighboring arguments and utilizing digits around recurrence of event.
- The most basic attributes of an arrangement of discourse blend are coherence and expectation. Intelligibility is the simplicity with which the understanding of output is done whereas naturalness portrays how intently the output sounds as a

speech of human. The perfect synthesizer of speech ought to be both intelligible and natural. [8]

Summary

This chapter is to introduce the field of artificial intelligence in which natural language processing and its tasks then speech technologies. The chapter began with the basic definitions of important terms. To understand the relevance of speech synthesis, the applications of TTS synthesizers are presented. The motivation for this thesis happens to be the application of TTS synthesizers for increasing human-computer interaction for people using Punjabi as their native language.

CHAPTER 2
REVIEW OF LITERATURE

Text to Speech had been the interest of most of the researches from last decade. Text to Speech was for various specialization fields (Android, Embedded System, and Education etc.) had been developed various languages. Approach to give a text as an input and a technique can play an important role to convert into a speech in an effective manner. Depending on the area of application, appropriate methods to be adopted. Following are the papers reviewed for the understanding of the subject.

2.1 TEXT TO SPEECH TECHNOLOGIES COMES UNDER THESE TECHNIQUES

Ancy Anto et al. advanced a Text to Speech Synthesis System for English to Malayalam Translation [1]. This is use speech synthesis and recognition had been the two rising technologies inside the communique field. This paper paintings aims to assist people to translate English textual content to their personal language and put into effect a TTS for the minority language, Malayalam. It completed via combining each Machine Translation and TTS. When an English textual content was given, it translated to Malayalam with the assist of a parser, the use of grammatical rules, making use of morphology and a bilingual dictionary. From every of the translated Malayalam text, syllables are separated. A properly number of syllables had been recorded and stored inside the syllable corpus. Syllables concatenated to generate synthesized Malayalam speech. For the TTS system, accuracy verified by means of checking the naturalness and intelligibility. 87 chances of the sentences are uttered successfully.

Deepshikha Mahanta et al.invented Text to Speech Synthesis System in Indian English [3]. This paper is achieved a piece on Grapheme to phoneme conversion modules have been critical components in textual content-to-speech (TTS) systems. These modules function before the cellphone series is fed into the synthesis ordinary. American English pronunciation, they were not appropriate for use in Indian English TTS systems. An

effort had been made to adjust the prevailing English grapheme to phoneme dictionary by using enforcing specific rules for one specific type of Indian English, specifically Assamese English. That proposed technique of dictionary modification is carried out at the front give up of the Indian English TTS, evolved using unit selection synthesis and statistical parametric speech synthesis frameworks. The word blunders charge reduced from 46.67% to 7.69% after incorporating the range particular changes to the dictionary, indicating big perceptual development.

William A.Ainsworth implemented a system for converting English Text into Speech [28]. As the content portrayal of the attainability of changed over English content into discourse utilizing a cheap PC and a little measure of putting away information had been examined. At that point the content was divided into breath, gathers, the orthography converted into a phonemic representation, lexical anxiety is relegated to fitting syllables, then the subsequent series of images was changed over by blend by-principles into the parameter values for controlled a simple discourse synthesizer. The algorithm that used to perform these conversions are evaluated independently, and the intelligibility of the resulting synthetic speech is assessed by listening tests.

Xuedong Huang *et al*. developed a trainable test -to-speech system [4]. In this paper the researcher told about the automatically learns the model parameters from a corpus. Both prosody (investigation of complement) parameters and connect discourse units are inferred using probabilistic learning strategies that had been effectively utilized for discourse acknowledgment. At that point the creator can deliver manufactured discourse that sounds exceptionally regular and looks like the prosodic attributes of the first speaker. Presently to hidden the innovations utilized as a part of whistler can altogether support the path toward making nonspecific TTs structures for another tongue, another voice or another talk style. Finally the information driven approach could make discourse yield that has ideal models move affect.

Anand Arokia Raj *et al*. discussed the text processing for text to speech system in Indian language [29]. In this paper researcher explained the nature and challenges connected with building content preparing segments of TTS frameworks in Indian dialects. And What's more, talked about the significance of textual style ID and textual style to-Akshara transformation and proposed a TF-IDF based approach for text style

recognizable proof. A novel approach of changed over from front-to-Akshara utilize the states of the glyphs and the absorption tenets was clarified. In this it could likewise focused on the execution of verbalization models for different segments including applicable, syllabic and acoustic phonetic components. At last, we had demonstrated that syllable-level elements could be utilized to construct a content standardization framework.

AlexandreTrilla reviewed Natural Language Processing techniques in Text-To-Speech Synthesis and Automatic Speech Recognition [4]. In this paper the author utilization of NLP systems was generation of sound from an information content. Content To-Speech combination, and the backwards procedure, which is the era of a made substance elucidation from a data voice explanation. Programmed Speech Recognition. Its abilities can however be improved using NLP going for more normal interfaces with a specific level of learning.

J. O. Onaolapo *et al.* reviewed a simplified overview of Text-To-Speech Synthesis [25]. PC based Text-To-Speech frameworks render content into a capable of being heard shape, with the point of sounding as characteristic as could reasonably be expected. This paper tried to disclose Text-To-Speech combination in a disentangled way. Accentuation is put on the Natural Language Processing (NLP) and Digital Signal Processing (DSP) parts of Text-To-Speech Systems. Applications and constraints of discourse combination were likewise investigated. The Digital Signal Processing module vocalizes the information content. A few used of content to-discourse blend had likewise been inspected.

 Kaladharan N *et al.* developed An English Text to Speech Conversion System [31]. This paper had exhibited to change over the worldwide dialect English content into discourse sign. The trading of content to discoursed made by the discourse synthesizer. Discourse blend was the impersonation method of human discourse. Content taking care of and discourse era were two fundamental instruments of content to discourse framework. In a content to discourse framework, talked words were naturally shaped from content. The outrageous crucial gifts of an integrated discourse are validity and familiarity. Content to discourse framework would bolster in sparing the data from sites

and records that contain data in various dialects. Database arrangement, character acknowledgment and content to discourse change are the basic stages in content to discourse investigation.

Sonal Bhatt *et al.* invented Natural Language Processing with Text-to-Speech on Android [3]. This paper presented the detailed implementation approach for interactive natural language system with 'Cab Reservation' application on Android smartphone. By using the speech synthesizer technology for the android, the application presents the modality of text-to-speech responses on android device. Now researchers designed and implemented language dialogue for Android smartphone that allows a process of booking a cab. It also allows the user to ask open ended question related to cab, are more conversational. I had accounted all possible outcomes of the user's utterances and have built a reply for every possible situation.

Shruti Gupta *et al.* reviewed the comparative study of text to speech system for Indian language [23]. In this paper the researchers basically review the your Indian dialect content to discourse frameworks, named Dhavni, Shruti, a HP lab framework in view of celebration structure and Vani framework talked about. At that point these frameworks looked at on the rudiments of dialects its support, size of discourse units, procedures used to code, store and amalgamations the discourse and prosody .Now specialists observe that all Indian dialect scripts have normal phonetic base. There was pretty much coordinated correspondence between what is composed and what is talked. The standards required to outline letters to hints of Indian dialects are straight forward. Subsequently, a typical TTS can be gathered for every single Indian dialect.

2.2 TEXT TO SPEECH RELATED PAPER IN PUNJABI

Mohit Dua *et al.* Evolved a Punjabi speech to text for related words [9]. The closing purpose of studies on Speech to Text system is to build machines that are indistinguishable from humans in the potential to talk in herbal spoken language. This paper discusses the implementation of a related phrase Speech to Text device (STT) for the Punjabi language. Hidden Markov version toolkit (HTK) have been used to develop the device. A Java platform primarily based Graphical User Interface (GUI) had been developed to make the machine speedy and user friendly.

Pardeep Gera implemented a text to speech synthesis for Punjabi language [2].In this paper the researcher work had been gone for building up a TTS synthesizer for Punjabi dialect. As an initial move towards this end, an investigation of the diverse structures for various TTS synthesizers for Indian dialects was finished. This study helped in choosing that Dhvani TTS synthesizer for Hindi dialect can be an appropriate decision for stretching out it to bolster Punjabi dialect. At that point it can used to execute this by utilizing Dhvani TTS synthesizer. It could put away all documents in database gsm compressed.gsm documents recorded .Then it tried on test information and assessed for the nature of the discourse created .The test outcome demonstrate incorporated discourse from Punjabi TTS synthesizer was very tasteful.

Maninder Singh developed text to speech synthesis for numerals into Punjabi Language [1]. In this paper author can do work on numerals in which speech waveform is generated and applies it to Punjabi speech synthesis using the general speech synthesis architecture. A methodology used for converting text to speech for Punjabi (Gurumukhi) language and the algorithm used for it.it can also use a library file of the Microsoft i.e. Speechlib.dill file which produces the speech using function Speak Voice defined in the library and make the computer able to speak by itself. While this had yielded intelligible sounding speech, the voice quality was unacceptable for widespread adoption. There had been a major technological paradigm shift in how speech synthesis done going from rule based to explicit data driven methods.

Parminder Singh *et al.* developed the Text-To-Speech Synthesis System for Punjabi Language [26]. This paper speak the approach used to expand a Text-To-Speech (TTS) synthesis system for the Punjabi text written in Gurumukhi script. Concatenate method were used to expand this TTS gadget the use of syllables because the basic gadgets of concatenation. After studying a cautiously decided on Punjabi corpus, we've decided on nearly thirty three hundred syllables out of approximately ninety three hundred valid Punjabi syllables. The system based on a Punjabi speech database that carries the starting and finishing positions of syllable-sounds classified carefully in a wave report of recorded phrases. The enter textual content became first processed and then syllabified with an automated syllabification set of rules that has been advanced primarily based on grammatical rules of Punjabi language.

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Jagmeet Kaur *et al.* implemented the Punjabi Speech Synthesis System for Android Mobile Phones [32]. In this paper the researchers develop a Punjabi text to speech synthesizer that can produce an output speech on a mobile device. While porting this TTS framework to an asset constrained gadget like cell phones, some reasonable perspectives like application size and preparing time are considered. The Concatenate Speech Synthesis method had been utilized which utilizes the Phonemes as the littlest single units for link. The extent of the discourse database is 13.1 MB with 578 phonemes sounds extricated from the recorded sound document and the span of this Punjabi TTS application is 10.3 MB. The created framework indicates great results for division of words into phonemes and can section the content of any length to the phonemes. This application primarily caters the requirement for outwardly powerless individuals who can't read.

Kamaldeep Kaur *et al.* This paper added Named Entity Recognition (NER) for Punjabi [9]. NER is a sub trouble or utility of NLP. Not an awful lot work had been accomplished in NER for Indian languages in standard and Punjabi specifically. Adequate annotated corpora aren't yet to be had in Punjabi. The paper represent the Name Entity Recognition gadget for Punjabi language to searching for and classify words which represent proper names in textual content into predefined classes like vicinity, person call, organization, date, time, designation and so forth. First we survey approximately the various tactics available for NER, then represent our hybrid technique for Punjabi. A number of language impartial and language based capabilities are extracted.

Preeti *et al.* Reviewed natural language processing (NLP) work began more than sixty years ago; it is a field of software engineering and etymology gave to making PC frameworks that utilization human (regular) dialect [27] . Common Language Processing holds extraordinary guarantee for making PC interfaces that are simpler to use for individuals, since individuals will have the capacity to converse with the PC in their own dialect, as opposed to take in a specific dialect of PC summons. Normal Language handling strategies can make conceivable the utilization of regular dialect to express thoughts. On the off chance that the data frameworks group reacts to the test by building NLP frameworks with reusable segments through Open Source programming, the fate of NLP will begin looking considerably brighter.

Er. Sheilly Padda *et.al.* Applied Punjabi textual content to speech gadget the usage of transcriptions concept. That paper offered the technique closer to changing text to speech the usage of new technique. The conversion of text to speech device enable to provide user enter in Punjabi text and output it gets sound. That paper supplied the stairs accompanied for converted textual content to speech for Punjabi (Gurumukhi) language and the set of rules used for it. That targeted at the tokenization manner and the orthographic represented of the textual content that shows the mapping of letter to sound the usage of the description of language's phonetics. Here the primary cognizance is on the textual content to IPA transcription idea. It is in fact, a system that translates textual content to IPA transcription which is the number one level for textual content to speech conversion. The whole technique for changing text to speech includes a fantastic deal of time as it's not a clean task and requires efforts.

Lots of work had been done in the area of text to speech synthesis system. Little work in this area is given as shown Table 2-1.

Table 2-1 Contribution of various Researchers in the Field of Text to Speech conversion

S. No.	Title Of Paper	Authors	Contribution Of Paper
1.	Punjabi Speech Synthesis System for Android Mobile Phones [9]	Jagmeet Kaur, Parminder Singh	It is represented a Punjabi Gurumukhi to speech synthesizer that can generate output in sound wave form. Few aspects like processing time and size of application on the mobile device
2.	Android Based Punjabi TTS System [10]	Hardeep, Parminder Singh	This paper examined the strategy which is utilized for developing synthesis system of TTS for content of Punjabi. The method of concatenate speech synthesis with phonemes is utilized as fundamental concatenation units.
3.	Punjabi Text-To-Speech Synthesis System [11]	Parminder Singh, Gurpreet Singh Lehal	This paper portrayed the Punjabi text to speech synthesis system. Concatenate method has been utilized and syllables have been stated as good selection of unit of

			speech for databases of speech for many languages.
4.	Improved System for Converting Text into Speech for Punjabi Language [12]	Ramanpreet Kaur, Dharamveer Sharma	This paper discussed few enhancements in the text to speech synthesis system which is format based for input text of Punjabi. Analysis of eSpeak for Punjabi is done and then faults are accurate by utilizing eSpeakedit.
5.	A Technique for Speech Synthesis of Gurmukhi embedded in LATEX document [13]	Jaswinder Singh, Tirath Singh, Sarabjit Singh, Brahmjit Kaur	In this paper, mapping of Gurumukhi script which is embedded in Latex document utilizing Pandey package for the respective audio files of Punjabi is done. Parsing is used in this process.

SUMMARY

This chapter presents the detail of all the literature surveyed and reviewed for the understanding of subject. Papers related to theme based search and text to speech have been given in section 3.1. For grasping the knowledge about processing Punjabi language words, various papers presenting different technologies developed. It has been found during the literature survey that there is not any TTS synthesizer available for the Punjabi language. Chapter 3 represents the scope of the text to speech conversion in Punjabi language.

CHAPTER 3
PRESENT WORK

3.1 PROBLEM STATEMENT

Throughout the most recent couple of years there has been an incredible improvement of the nature of the discourse delivered with content to discourse [1]. Many individuals surmise that engineered discourse as it is additionally called sounds like robots from more established motion pictures. In all actuality however that a few voices practically stable like recorded discourse.

The best upgrades with regards to characteristic discourse were amid the most recent 10 years. The principal voices utilized for ReadSpeaker back as a part of 2001 were delivered utilizing Diphone blend [2]. The voices are tested from genuine recorded discourse and split into phonemes, a little unit of human discourse. This was the principal case of Concatenation union. Be that as it may, regardless they have a simulated/engineered sound [26]. Despite everything we utilize diphone voices for some littler dialects and they are broadly used to discourse empower handheld PCs and cell phones because of their restricted asset utilization, both memory and CPU.

It wasn't until the presentation of a system called Unit choice, that voices turned out to be actually sounding [1]. This is still connection amalgamation however the utilized units are bigger than phonemes, some of the time an entire sentence. We utilize diverse suppliers for various dialects to dependably guarantee we can offer the best voices accessible for that dialect.

Before the development of this system, the text to speech system was not developed for words, numbers, and integers convert into Punjabi language. In the system or software developed before, to develop this system firstly we have to record the sound like .wave files in human voice, then these files were used to convert the number into So, it is proposed to develop a system which is able to guide laymen about Punjabi language. It will pronounce the Punjabi letter (dictation set of thing).It has been found that this kind of system is not developed it.

3.2 OBJECTIVES OF THE STUDY

1. To make and pre handle content image information utilizing standardization to produce the total number of normalized letters or words.

2. To perform training of list of capabilities of image utilizing nourish forwarding algorithm.

3. To perform coordination of testing image with prepared information and show those word sounds in different contexts. Later these words have been marked and stored in the speech database to get natural sounding synthesized speech.

4. The accuracy of text to speech conversion is compared with Splitting Algorithm and attempt is to enhance its efficiency.

3.3 METHODOLOGY

- Create Database for Training – To Train Images, we save some images of Punjabi letters in 1 folder and choose them one by one. This folder is help to load in MATLAB.

- Load Images in MATLAB – Using imread command in MATLAB, we load images in MATLAB. And save in it.Then it have easier to use the letter of image.

- Convert Image to BW: im2bw (I, level) function is used to converts the image I to a binary image. The output black and white image replaces all pixels in the input image with luminance greater than level with the value 1 (white) and replaces all other pixels with the value 0 (black). We use rgb2gray command for it. And also use bw and bw areopen commands.BW sands for black and white image.

- Find the Boundary of the Image – To find the Boundary of Image we can use either edge detection method or contour detection, this section give us boundary of the character.

- Find the Left side, right side , upper side and lower side blank spaces- After finding the boundary the character , we try to eliminate left side, right side, upper side and lower side of character so that we crop only character region and reject extra space.

- Crop the Image to its edges- we crop the images according to parameters we find in above section and save it.It can also use in MATLAB imcrop command. It will also crop an edges of image .And then resize the image.

- Convert the Image into single feature vector- we now convert cropped image into single vector so that we get a single vector neural network training. With the help of Simulate command training perform. That command is used in neural networks. Sim is the abbreviation of simulate.

- Concatenate all the feature set of training dataset in single vector- After detecting factors we combine all together.

- Choose the feature set from vector that we want to train-From whole vector we can choose particular features that we want to use for training.

- Declare target matrix according to the classes we want to define to Neural Network- we define classes for our vector that we take

- Perform the training using these 2 Matrices and Obtain net file – Using classes and feature vector , we train our neural network

- Save this NN net for testing- we save neural network NN file to use it for testing.

- Choose any Image from Dataset for testing- We choose the image that we want to test

- Perform all pre-processing operation on Image as defined above- we perform all pre-processing operation on testing file that we apply on training images.

- Perform Neural Network testing using input image and net file- using NN file and test file, we extract the output. And also for output nn compet command.

Table 3.1: Main task to build tts system

S.NO	MAIN STEPS	DISCRIPTION
1	Preprocessing	It is the main step for implement the tts system. Preprocessing mean to process the image that we used with the help of cropping ,gray scale etc.
2	Feature Extraction	Second step to develop tts is feature extraction. Feature extraction means that extract the letter and words from the image .that should be local and global feature extraction.
3	Feature Selection	Another step is feature selection in which we can select the feature of image with the help of filter method, wrapper method and last is hybrid method.
4	Classification	Classification means to classify the letter r words with the help of hidden marko model, Bayesian.
5	Post Processing	This is the last step of the tts system.in which it process the text data into speech wave form output.

Table 3-2 Types of processing

S.NO	DIFFERENT PROCESSING TYPES	DESCRIPTION
1	Binarization	It means that image can process according to binarization way such has given the values 0 for back image and 1 for white image that also help for convert the image into back white .
2	Cropping	Cropping means to crop the image .In which crop all the edges, left space and right space of the image.
3	Noise reduction	Noise reduction is use in data mining to reduce the noise of data and also remove all the obstacles.
4	Segmentation	Another type of processing is segmentation that can dive the image into a segments. This is also used in this work.

Table 3-3 Different types of feature extraction

S.NO	FEATURE EXTRACTION	DESCRIPTION
1	Local Feature	It is used for a single letter such as geometric.
2	Global Feature	It is used for line and paragraph.

3	Structural	It have a topological and geometric properties .that use aspect ratio ,cross point, loops branch points etc.

3.3.1 Algorithm of text to speech system for Punjabi

Step 1: Punjabi text is converted into voice by using neural network (simulate command).

Step 2: The text data is in .imread extended format and is import to MATLAB environment.

Step 3: Input text is split into segmentation as words and letters.

Step 4: Words and letter are segmented based on set of rules added. Most basic rules used is, at every occurrence of vowels and constant in a word it is segmented at the position. .

Step 5: Then crop letter or words that we want and start matching of those crop word or letter.

Step 6: Here phonemes corresponding to grouped letter and words are extracted from the recorded sound.

Step7: Thus speech output is obtained.

3.3.2 Collation algorithm

```
type
    collationletter=Record
    v1, v2, v3: byte;
end;
    segmentationkey: Array of String;
    var
    letterword: Array of String;
    cropletterword: String;
    CL: Array of collationletter;
    SK: Array of segmentationkey;
    i ,cout ,integer ;
    begin
```

```
i=0;

while i<cout do

begin

crop (letterword[i], cropletterword);

generatedcallationletter (cropletterword, CL);

generatesegmentationkey(CL, SK[i]);

i++;

end;

segmentation (SK, letterword);

end;
```
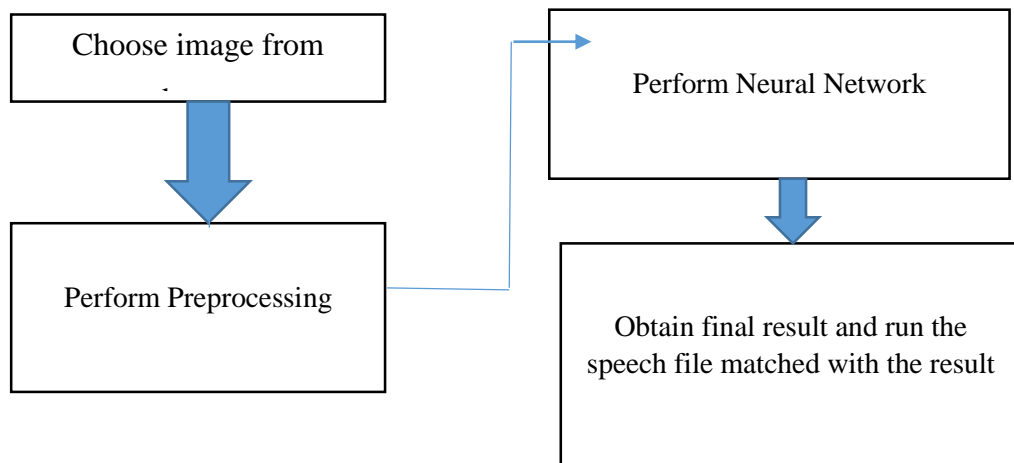

Figure 3.1: Testing of data

Here choose image from the stored data set .Then perform preprocessing with the help of segmentation .After this start perform neural network algorithm feed forwarding commands such as simulate. At last obtain in final result and run the speech file one by one matched with the result. Basically this Figure 3.1 is help for testing of data.

Now first we create a data set of different Punjabi letters images and words that stored in one folder .Than start preprocessing of these images with the help of its types like convert the image into black and white. And find all the boundaries and black spaces from all the sides left, right, top and bottom. After this start crop all the edges of the image.
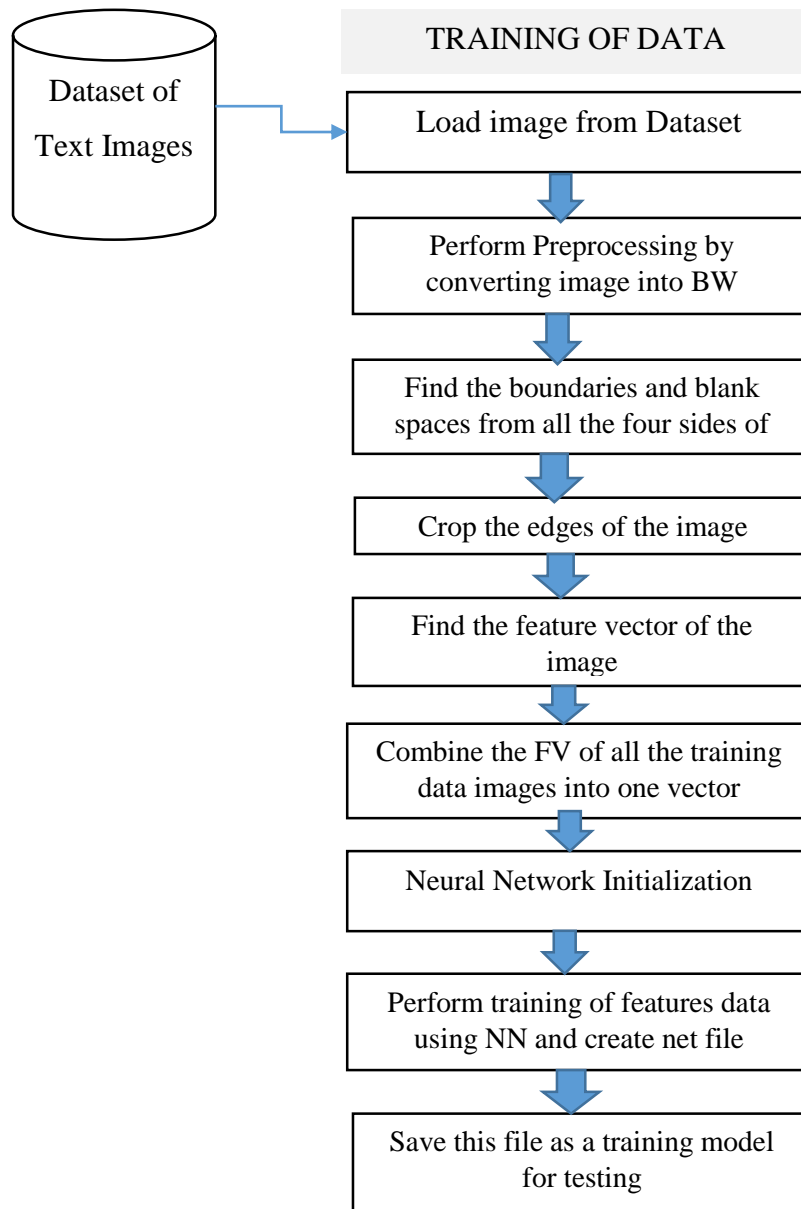
Figure 3.2: Flow diagram

Now start finding all the feature vector , combine all the training data images intp one vector then start neural network algorithm feed forwarding and perform the training of feature data using NN and create net file .At last save all this file for testing .All these steps shown in Figure 3.2.

CHAPTER 4
RESULT AND DISCUSSION

4.1 EXPERIMENTAL RESULTS

There are two most important techniques for fixing the TTS paradigm. The first one makes use of simple units that are either recorded speech segments or parameters representing those segments. These units may also correspond to words, phonemes or maybe sub phonemes, as used on this thesis. This speech technology method is referred to as Concatenates TTS (CTTS). In this method, speech is generated by using concatenating the nice compatible segments in keeping with positive concatenation regulations. By this approach, generated speech inherently possesses herbal best. However its high-quality relies upon on the size of the recorded database, as notable CTTS wishes an intensive database. In thesis paintings, A Text to Speech machine has been applied that paintings most effective for letter convert those written letter into Punjabi speech.

And another one is handwrite method the usage of neural networks. In which we will write a Punjabi letter on paper and click on image of letter and trained with the help of neural community and supply bring about voice. Both approaches performed in MATLAB.

The name MATLAB stands for Matrix Laboratory. MATLAB was written at the beginning to provide clean get entry to matrix software advanced via the LINPACK (linear system package) and EISPACK (Eigen machine bundle) initiatives. MATLAB is an excessive-overall performance language for technical computing. It mixture of computation, visualization, and programming surroundings. This is also a cutting-edge programming language surroundings: that guide all the image processing paintings and neural community work, it has also capability to find the mistake and also debug .That will make MATLAB an extraordinary tool for teaching and studies.

Many blessings of MATLAB to in comparison a conventional pc languages (C, FORTRAN) for solving technical problems. MATLAB is an interactive machine to apply images commands that make the visualization of consequences right away to be had. Special packages are collected in programs are toolbox. There are toolboxes for

sign processing, symbolic computation, control principle, simulation, optimization, and several other of applied technological know-how and engineering.

Starting MATLAB:

After logging into your account, you may enter MATLAB by using double-clicking on the MATLAB shortcut icon (MATLAB 2013a) in your Windows computer. When you start MATLAB, a unique window called the MATLAB laptop seems. The desktop is a window that incorporates different home windows. The foremost gear within or handy from the desktop are command window, command records, workspace, cutting-edge directory, assist browser and closing start button.
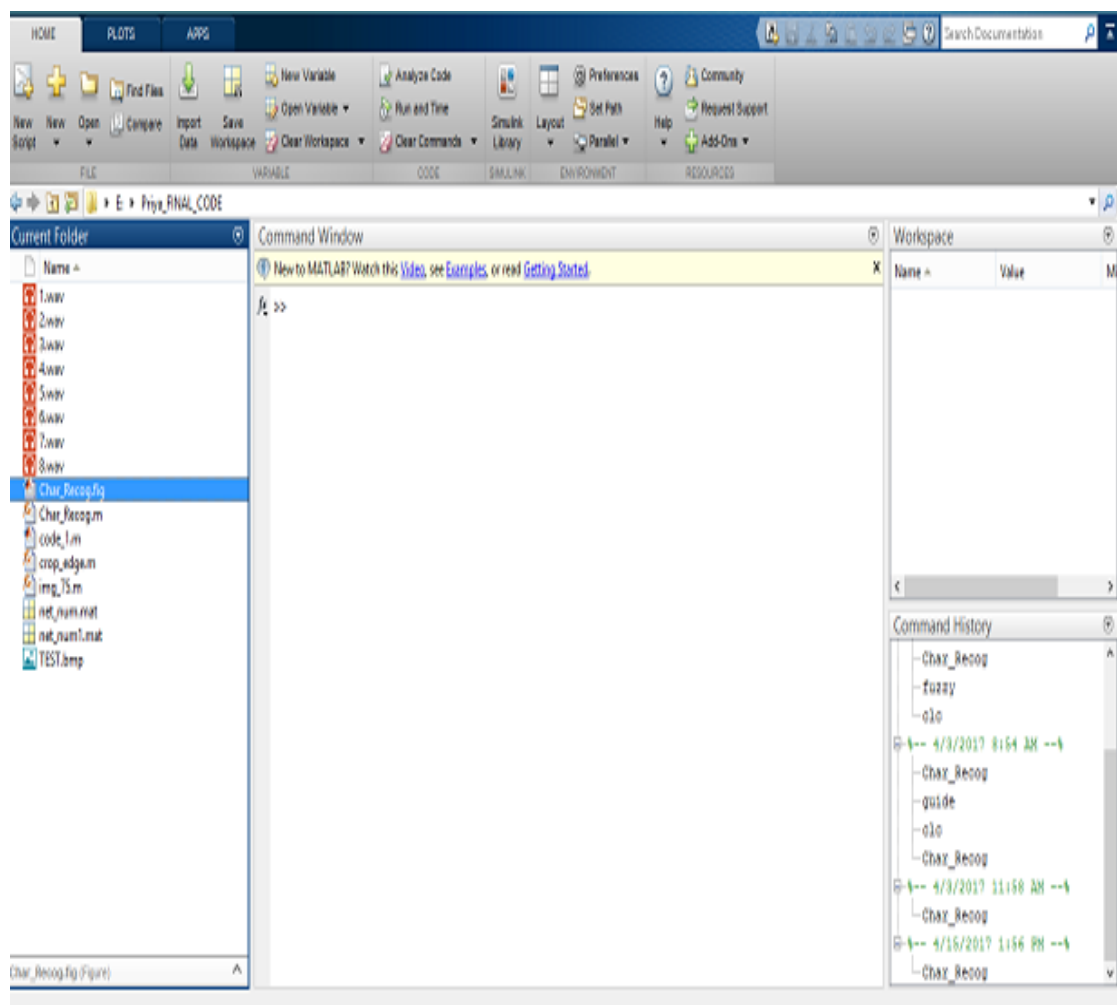
Figure4.1: Main interface of MATLAB

Command window is used for write a code on it. Then command history tell the error in code and execute the code. Workspace is defined the variable used in the program. That all shown in Figure4.1.
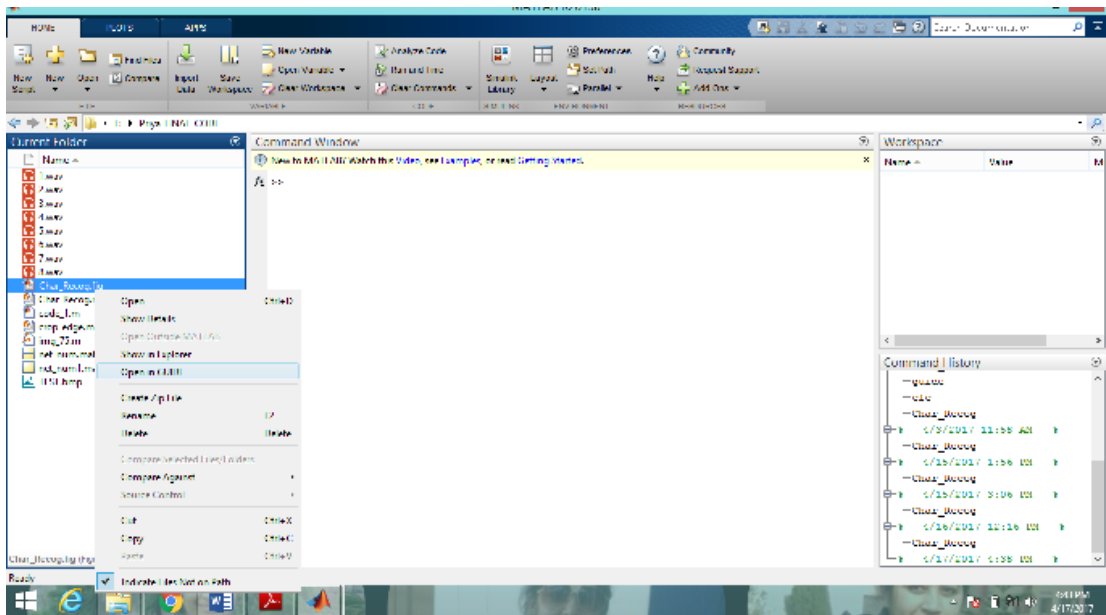
Figure 4.1.2: Interface of MATLAB

In this Figure 4.1.2 we can open the fig file. Click on the fig file and open the window that have multiple option like then we select open in guide .and guide page can be open.
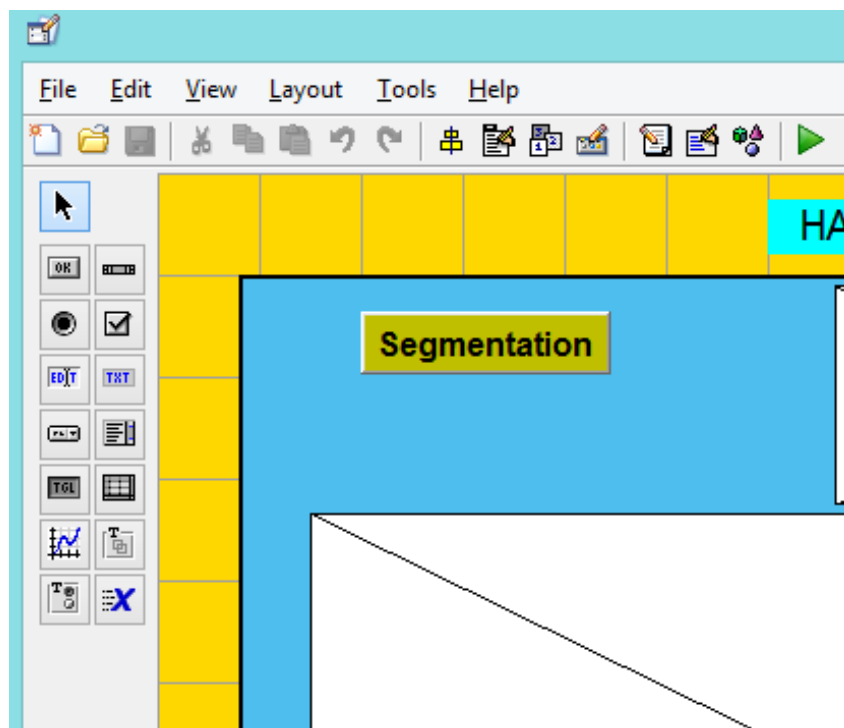
Figure 4.1.3: GUI interface

In this window have a menu bar ,and also a buttons ,axes and multiple option that we use with the help drag and drop option .we add a button using drag and drop option and then edit the name, color and font size etc. The button should be segmentation that perform a function of segments. After this segmentation button shown in Figure 4.1.3.

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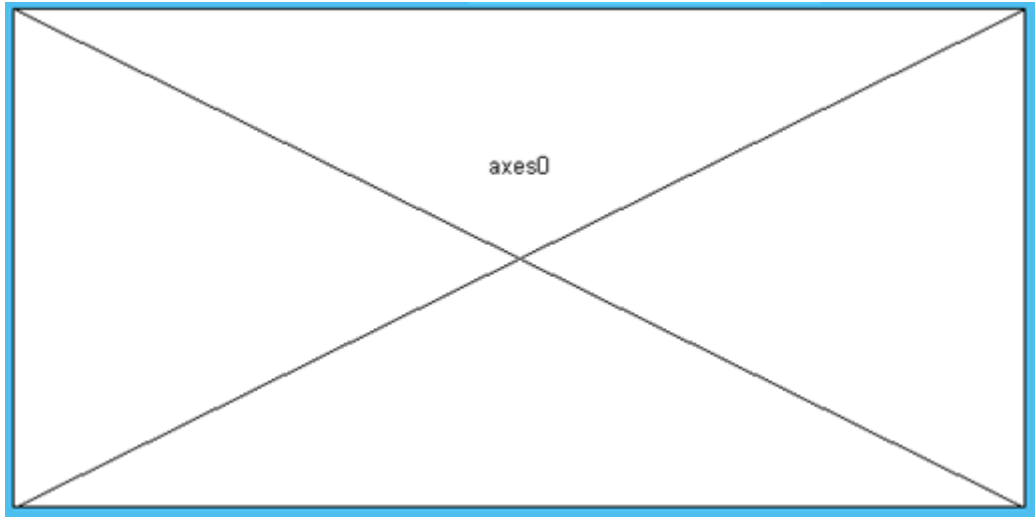
Figure4.1.4: Axes create on GUI

After adding the button of segmentation then we want to display letter on axes. The axes that we choose from the select bar by using drag and drop shown in Figure 4.1.4 and then we load the Punjabi letter and words image .That is helpful for represents image content in it such as letter, words etc.
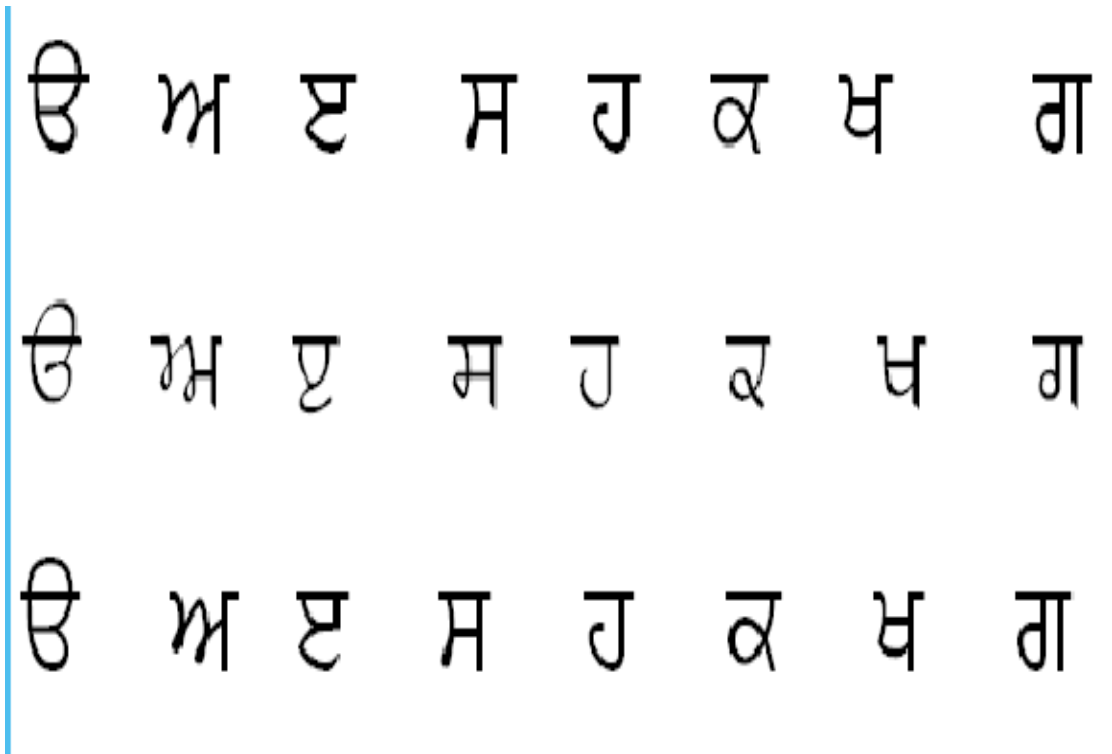

Figure 4.1.5: Punjabi letter image

In this the Figure 4.1.5 shows the different Punjabi Gurumukhi letters in different manners and all these letters are consonants. Each letter have different pronunciation and different meaning.
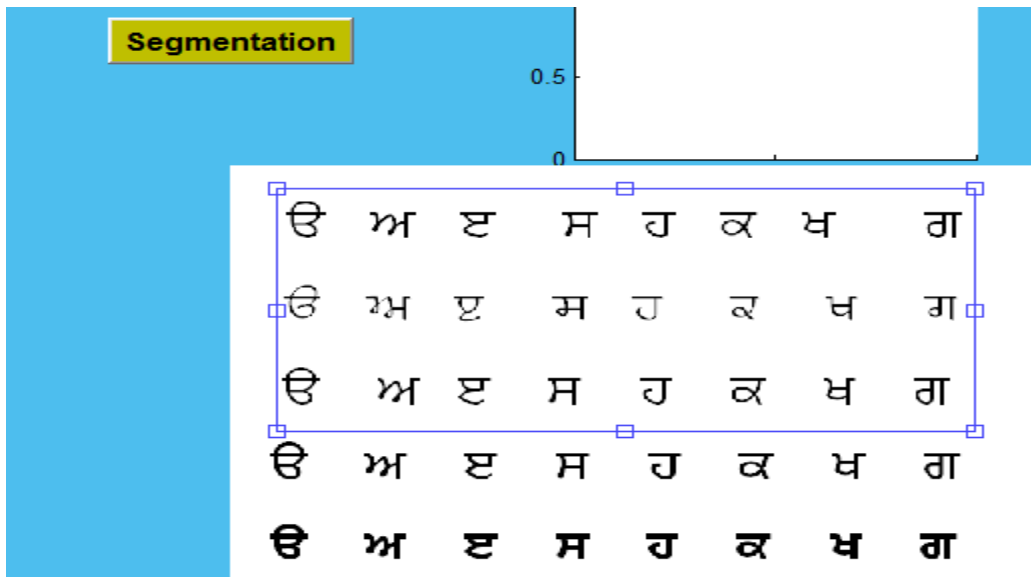
Figure4.1.6: Segmentation perform

In the previous Figure 4.1.5 Punjabi letters are shown and now we select segmentation button and segments the uploaded image on the axes image should contains of Punjabi Gurumukhi letters. Select the segmented letters that we want. That shown in Figure 4.1.6.
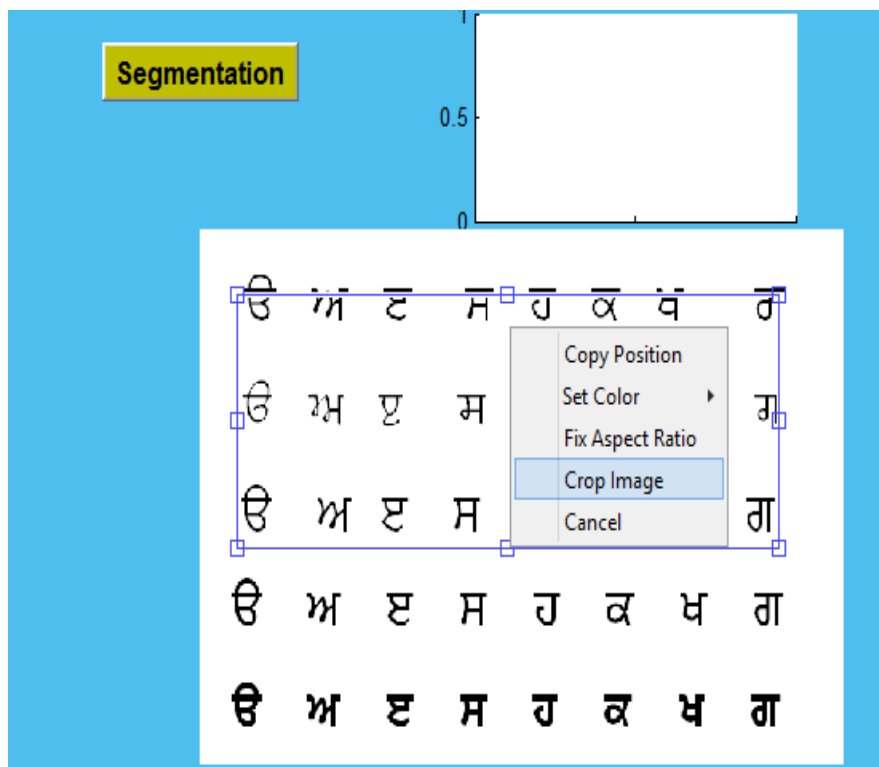

Figure4.1.7: Select to crop image

After segmenting the letters select the image that we want to crop then double click on the image .The new window will be opened that have multiple options such as copy

position ,set color, fix aspect ratio, crop image and cancel. Then we choose crop image option. That shown in Figure 4.1.7.
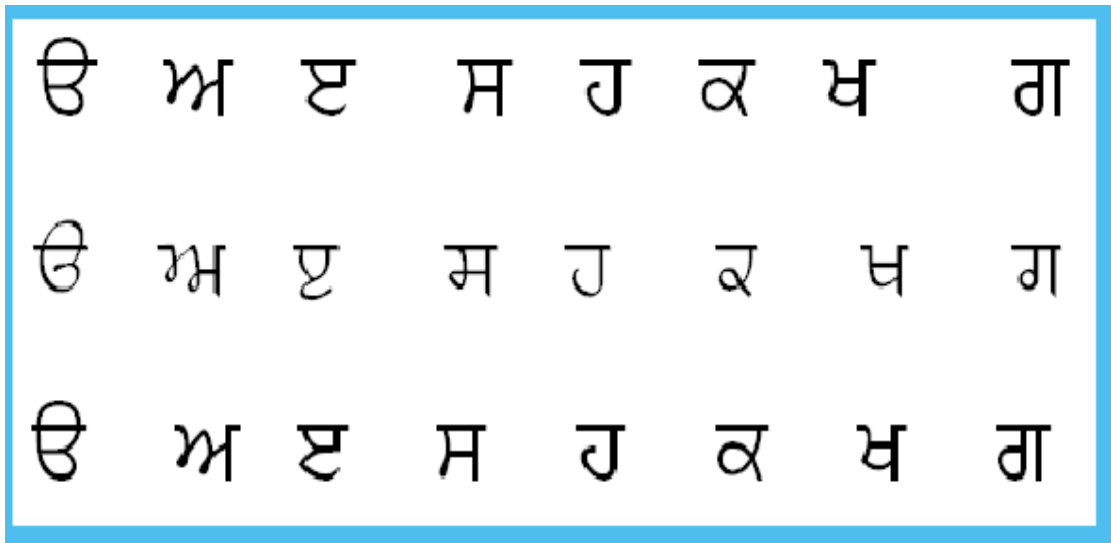

Figure 4.1.8: Cropped image

The crop image perform his action and crop the image that we want and display all the letters one after the other on the window. Then we create another axes on guide by using drag and drop option. On this axes display all the Punjabi Gurumukhi words one by one. That shown in Figure 4.1.8.

Figure 4.1.9: Count the total number of letter

After displaying all the Punjabi Gurumukhi letters on the window one by one it tells the total number of letters that we cropped by selecting the crop image . Then total number of letter shown in Figure 4.1.9.
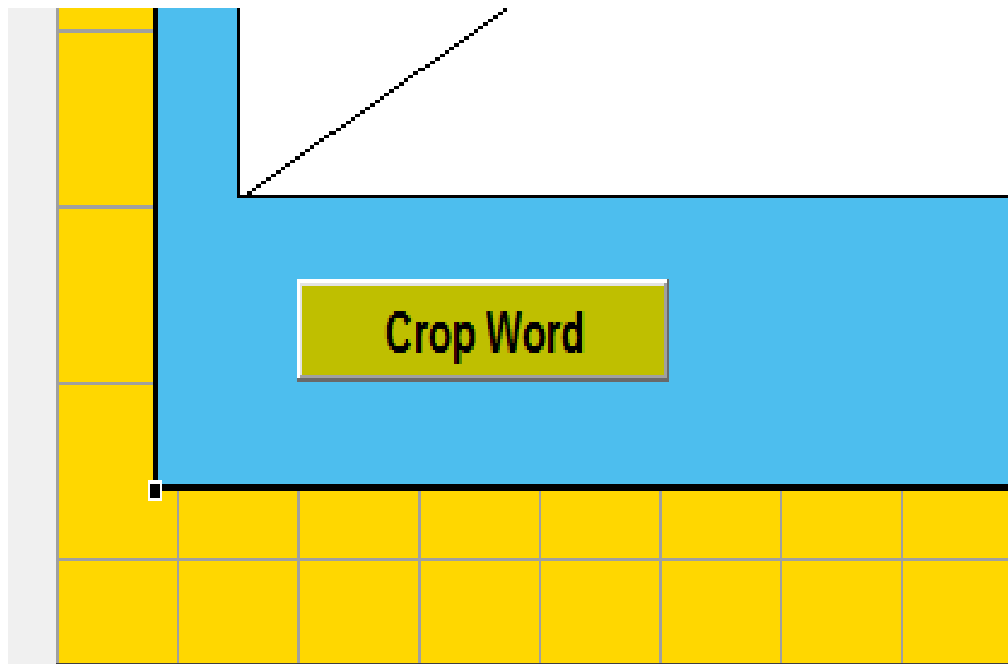

Figure 4.1.10: Display crop word button

After performing segmentation, crop the image letters and then count the total number of cropped letters that we crop with the help of crop image option .Now we select new button from the select bar add on the window. Rename the button that should be a crop word also add the color on this button that will be shown in Figure 4.1.10.
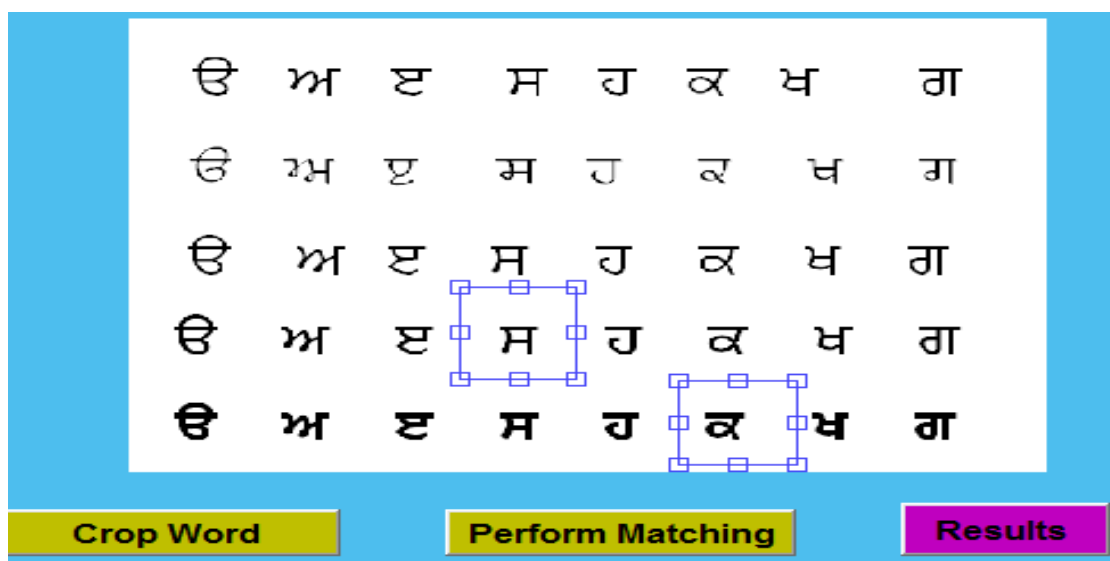

Figure4.1.11: Crop the single letter

Now press the crop word button after this button start functioning and go to the axes the have already loaded Punjabi Gurumukhi letter image showed on that loaded image and show that particular selected letter. And that selected letter shown in Figure 4.1.11.
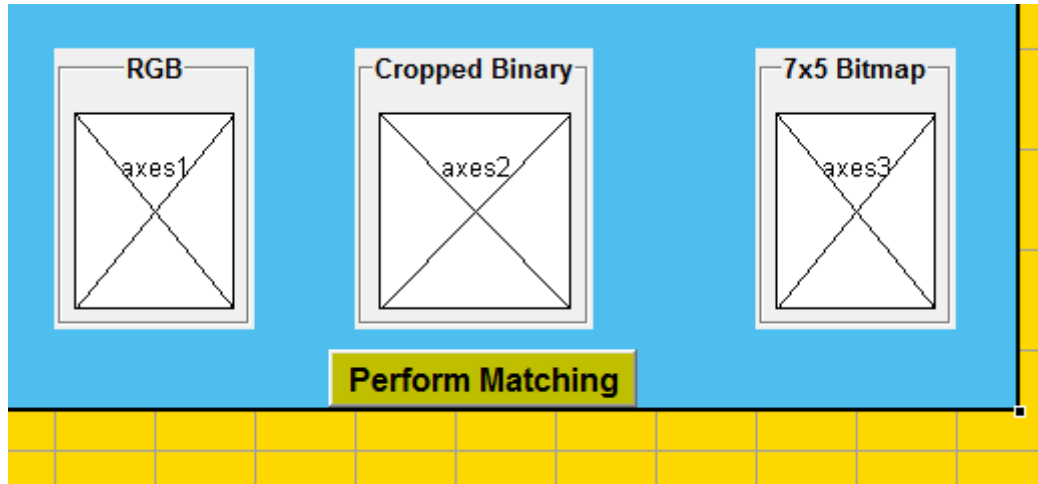

Figure 4.1.12: Perform matching button and axes

In this Figure 4.1.12 we want to perform matching of the crop words we add a new button "perform matching" from the selected bar .Then we need an axes. There we can perform the similar letter matching. The axes are axes1 is RGB that display the letter which are performed matching to cropped binary image .Another is axes2 which is cropped binary image and other is axes is bitmap that is the bitmapping of both images.
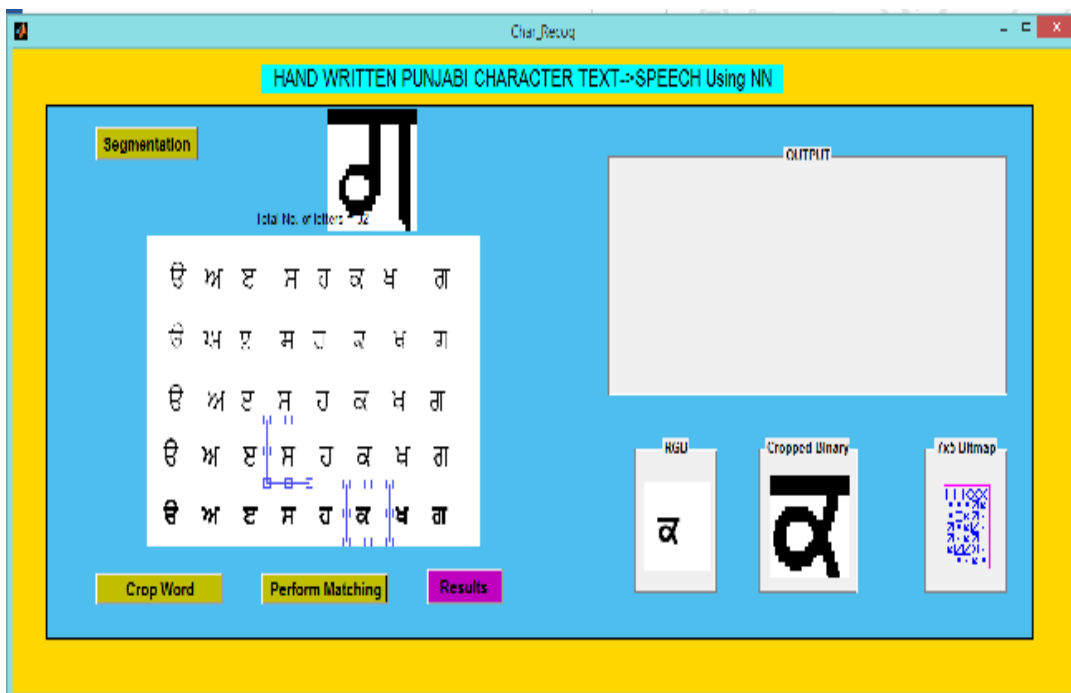

Figure 4.1.13: Match the letter on different axes

Perform matching button start functioning to match the letter that we are selected. After this the RGB axes pick the selected letter and matching with the cropped binary letter and show the result of both in the form of bitmap on the bitmap axes are shown in Figure 4.1.13.
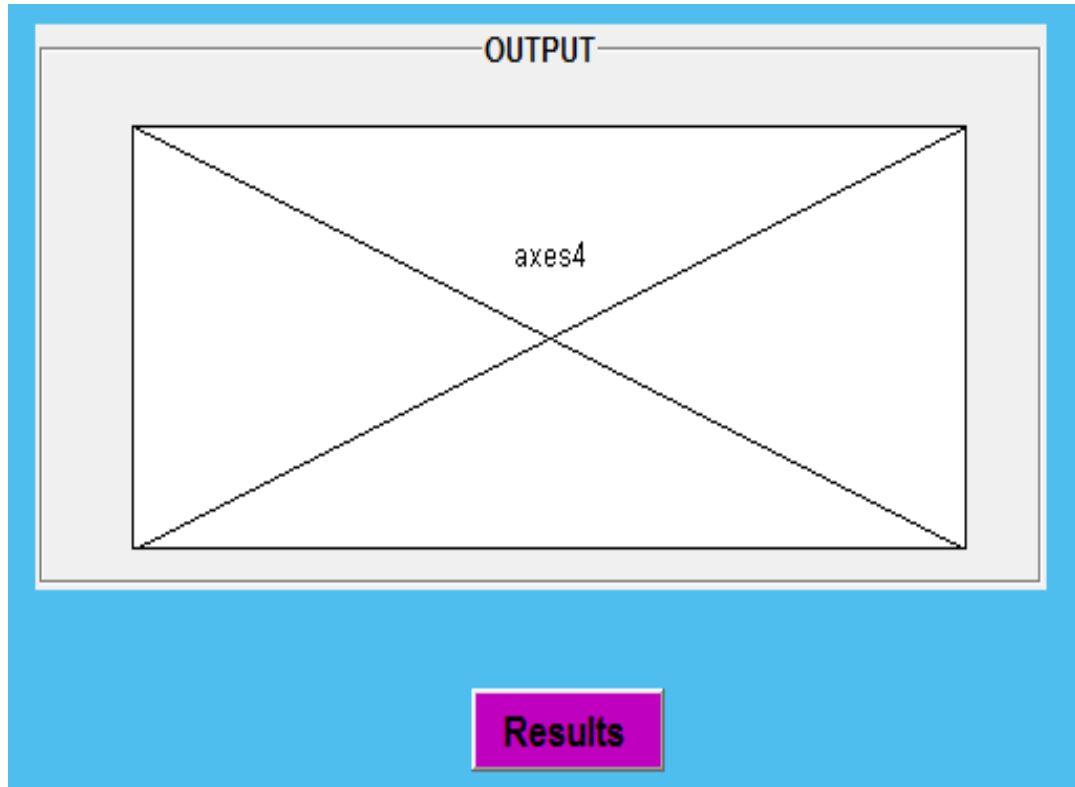

Figure 4.1.14: Result button

After segmentation, crop word and performing matching then we add a new button that is result button from the select bar and result button is shown in Figure 4.1.14. Now we required an axes that will be created from the select bar is axes4. In this axes we show the result in the wave form.
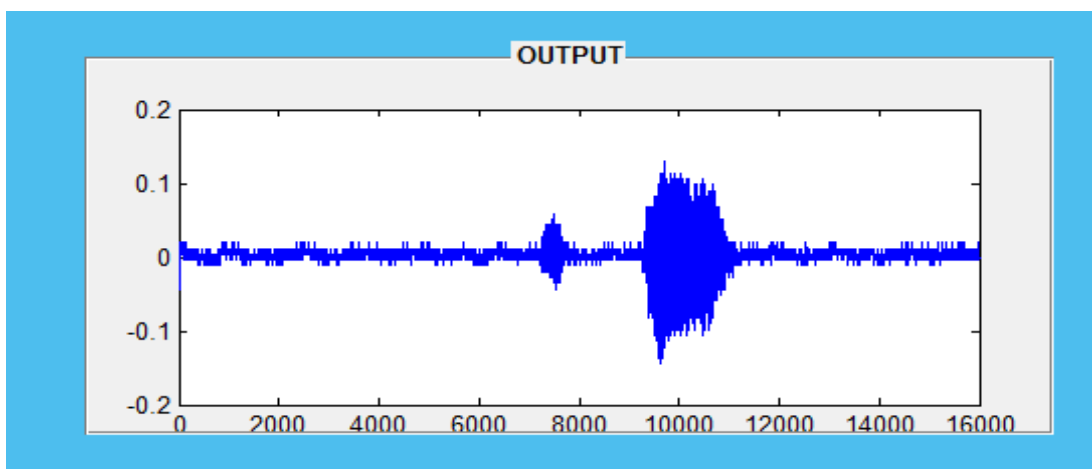

Figure4.1.15: Output in sound waveform.

Now we press a result button that will perform his action gives the result in the sound wave form that will be display in this Figure 4.1.15.
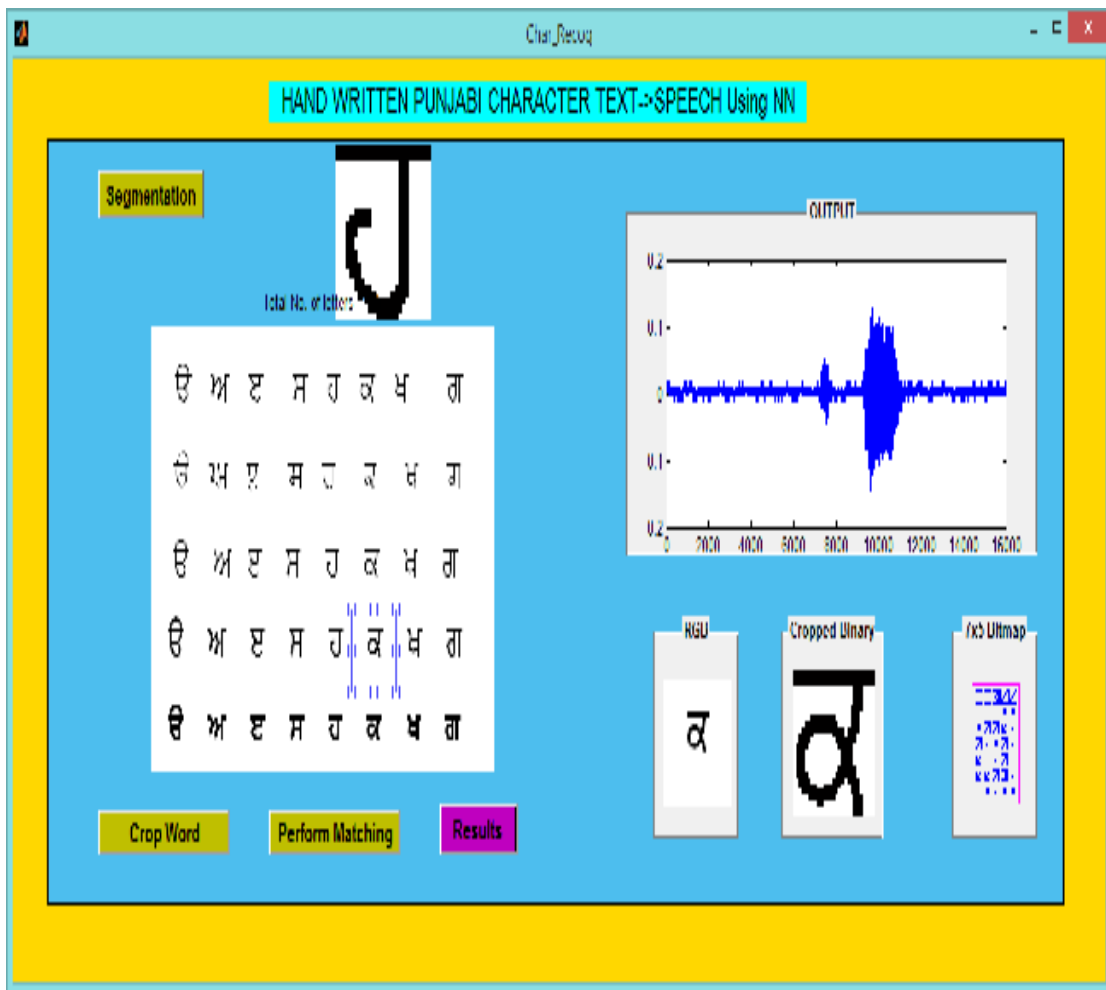

Figure4.1.16: Final GUI

This is the final representation of the implementation part that should be a combination of all the buttons and axes such as segmentation, crop word, perform matching and result .all the axes use for different purposes like axes 0 load the image that we want, axes 1 can tells the total number of letters that we cropped, then axes2 is RGB, axes3 is cropped binary, axes4 is for bitmap these three are used for perform matching. And last axes is for showing the result in the sound wave form. That shown in Figure 4.1.16.

4.2   RESULT OF PURPOSED APPROACH

In this part result is context on the basis of the different parameters of Punjabi letters and words matching. The above hypothesis is implemented in MATLAB 2013. Based on the new developed approach shows that the performance of segmentation time, matching time and total time. In the below figure 4.2.1 describes the analysis of single letter of Punjabi. . It shows the different values of single letter such as segmentation time is 24%, matching time is 45%and last is total time is 67%.
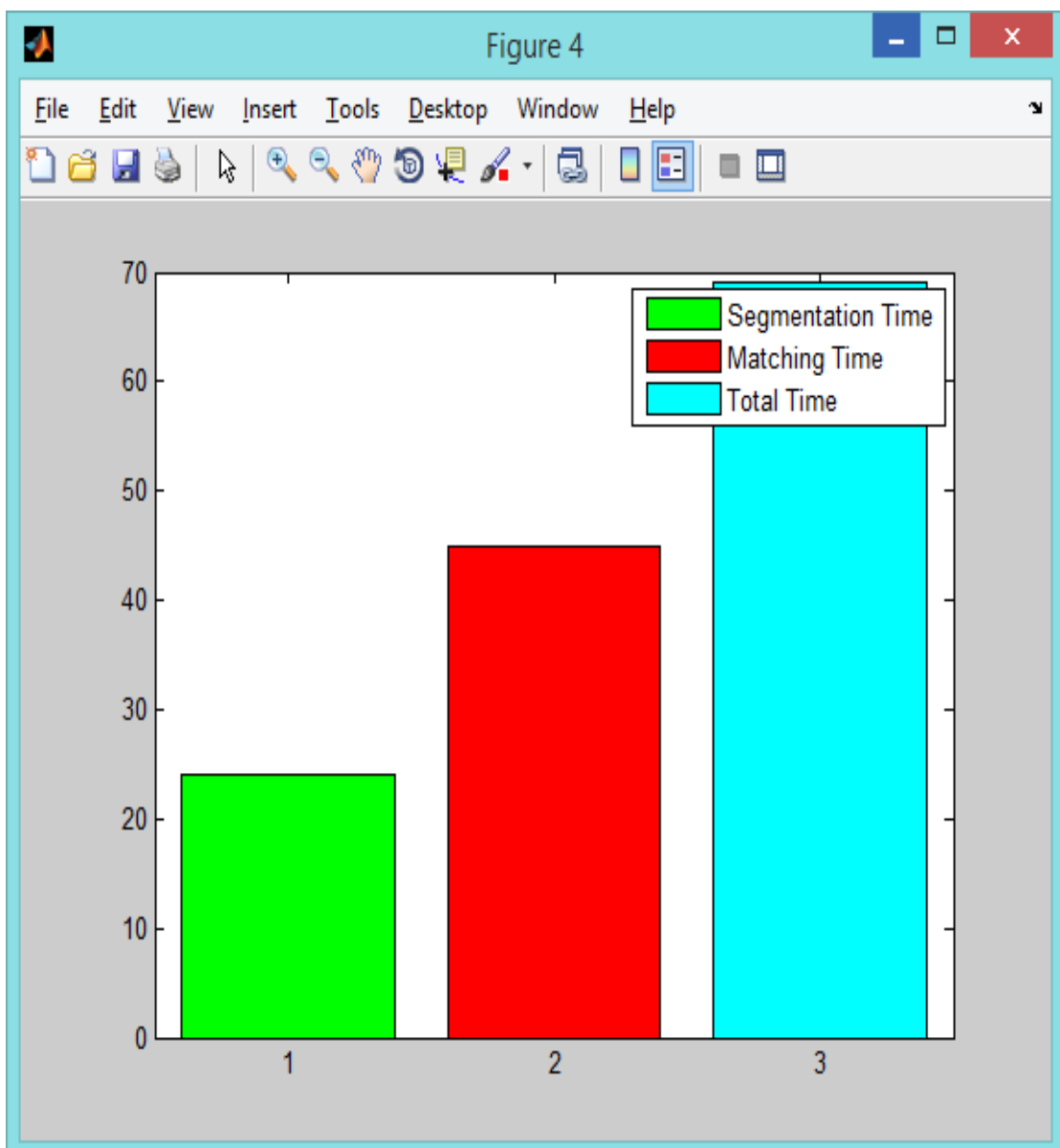

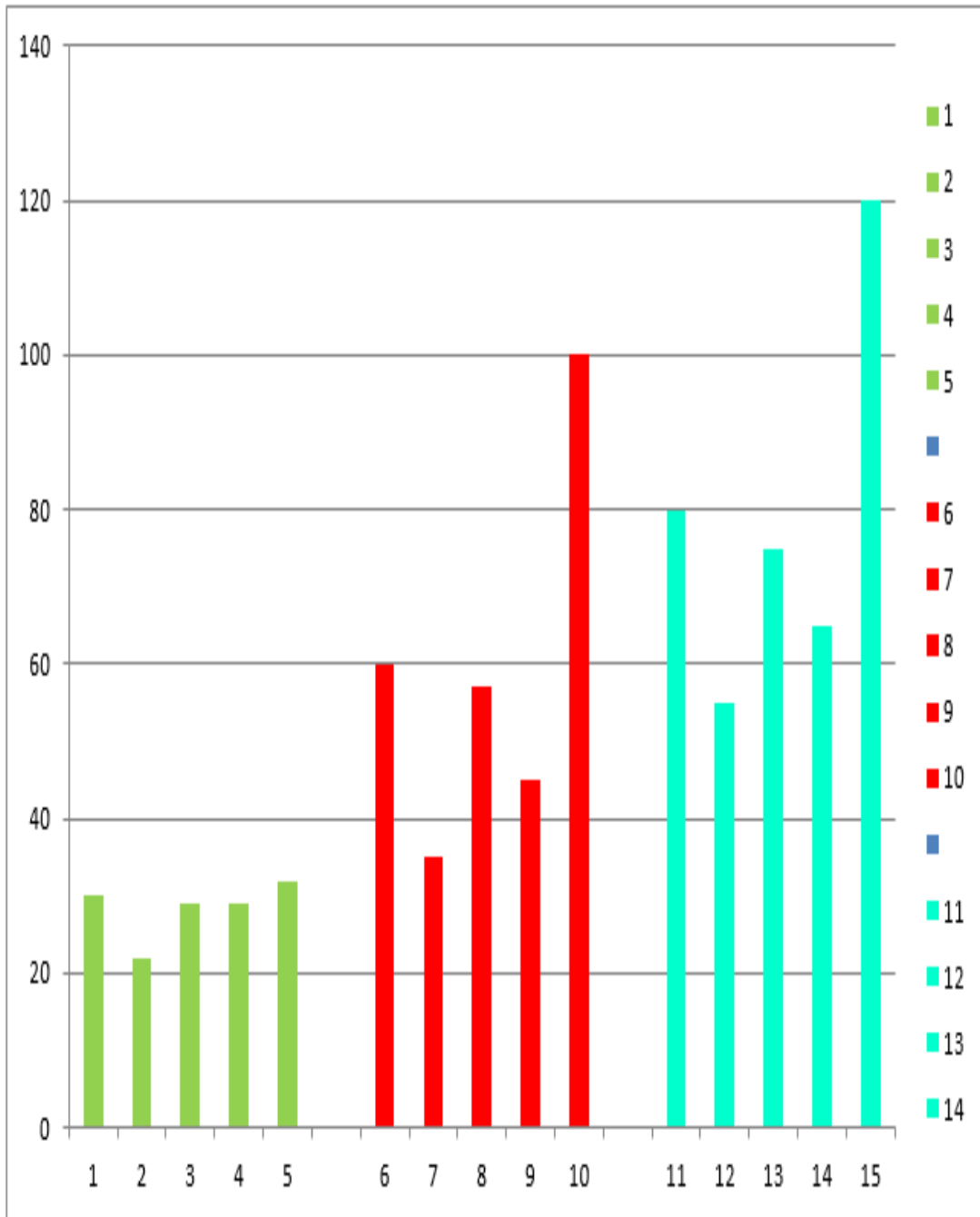**Figure 4.2.1:** Graphs for single Punjabi letter

Figure 4.2.2: Compression of different letter of Punjabi

In this figure 4.2.2 shows the different values of more letters of Punjabi. There green color represent the segmentation time of different letters. Red color tells the values of different Punjabi letter for matching time. And last one is see green represent total time.

4.3 COMPARISION WITH EXISTING TECHNIQUE

Table 4.1 Evaluation of Text to Speech system

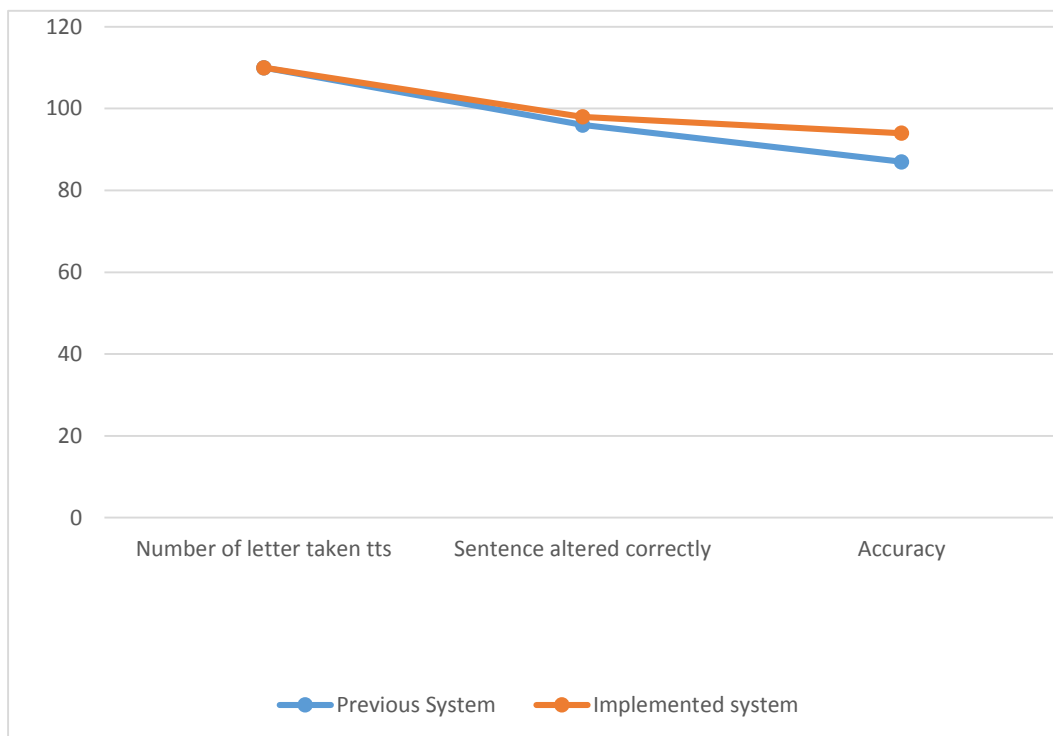| Parameters	Previous system	Implemented system
Number of letter and words taken TTS	110	110
Sentence altered correctly	96	98
Accuracy	87%	94%

Figure 4.2.3: Comparison of previous system and implemented system

CHAPTER 5
CONCLUSION AND FUTURE SCOPE

5.1CONCLUSION

An initial step towards this end, a study of the artificial technologies in which there is study of tasks of natural language processing has done. These tasks include speech recognition and speech synthesis. The speech recognition is used for changing speech into text. It uses automated speech recognition system. Then speech synthesis can convert the text to speech. It can convert with the help of some different tools such as Dialog system. The survey of various techniques of text to speech synthesis system. It is found that many systems for Punjabi language to speech conversion are yet to be formulated.

So it can make text to speech conversion in Punjabi that should be a combination of Punjabi Gurumukhi letters and words and also included consonant and vowels of Punjabi Gurumukhi that will make a letter of single consonant and vowels then combination of both. This all work is done in the MATLAB using some commands and neural network algorithm feed forwarding.

It will gives the different letters or words segmentation   time , matching time and total time.it improves accuracy as compare English text to speech synthesis.

5.2FUTURE SCOPE

In this future work can be done on the special letters and words of Punjabi Gurumukhi such as (. ,-,=,^). And also add more combination of vowels and consonants. In this she using also handwritten letter and words. So you can use another way or another approach.

Also improve the accuracy of the efficiency and add more number of letters, words and sentences. In this implemented system used only 110 letter and words.

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S.NO.	PUNJABI SYMBOL	EQUVALENT ROMAN
1	ੳ	u
2	ਅ	a
3	ੲ	i
4	ਸ	s
5	ਹ	h
6	ਕ	k
7	ਖ	kh
8	ਗ	g
9	ਘ	gh
10	ਙ	Mg
11	ਚ	Ch

12	ਛ	Chh
13	ਜ	j
14	ਝ	jh
15	ਞ	Mj
16	ਟ	T
17	ਠ	Th
18	ਡ	D
19	ਢ	Dh
20	ਣ	n
21	ਤ	t
22	ਥ	th
23	ਦ	d
24	ਧ	dh
25	ਨ	n

26	ਪ	p
27	ਫ	ph
28	ਬ	b
29	ਭ	bh
30	ਮ	m
31	ਯ	y
32	ਰ	r
33	ਲ਼	L
34	ਵ	w
35	ੜ	rh

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