

# CS699- Software Lab Project Report on Hindi Text to Speech

Saurabh Warade- 193050051  
Sanjay Kumar - 193050068

November 2019

# Contents

<b>1</b>	<b>Introduction</b>	<b>2</b>
<b>2</b>	<b>Goals</b>	<b>5</b>
<b>3</b>	<b>Methodology</b>	<b>6</b>
<b>4</b>	<b>DESIGN AND IMPLEMENTATION OF TTS</b>	<b>7</b>
<b>5</b>	<b>Work Done:</b>	<b>8</b>
5.1	Web application: . . . . .	8
5.2	Server creation using Python Flask: . . . . .	8
5.3	Training the Festival module using Transfer Learning: . . . . .	8
5.4	Challenges . . . . .	10

# 1 Introduction

Speech processing technology has been a mainstream area of research for more than 50 years. The ultimate goal of speech research is to build systems that mimic (or potentially surpass) human capabilities in understanding, generating and coding speech for a range of human-to-human and human-to-machine interactions.

Speech is one of the most vital forms of communication in our everyday life. Since speech is a primary medium for communication among human beings, it is natural for the people to expect to be able to carry out spoken dialogue with computers. This involves the integration of speech technologies and language technologies. Speech synthesis is an automatic generation of artificial speech signal by the computer. In the last few years, this technology has been widely available for several languages for different platform from personal computer to stand alone system. Today, the most common interfaces for human machine interaction are still keyboards, key-pads, and mice. However, an increasing necessity to interface with machines in mobile environments is leading to speech becoming a required means to interface with machines and automated information services.

TTS is a complex problem that has made significant progress in the realm of concatenative systems in the last few years. With the development of new techniques such as speech synthesis and speech recognition, we are now moving into an era of more effective TTS with improved prosody in the synthesized speech. Developing a text to speech system for a language that can support inputs in other languages can be helpful to the users who know the language but are not familiar with its relative keyboard layout. Users who do not know that language at all can type in that language using their local language keyboard layout. Many times, Indian users prefer to type Hindi sentences in English Script. This fact is more prevalent over mobile SMS application, chatting and the social networking websites. Users do this because they are used to the English QWERTY keyboard and due to non-familiarity and nonavailability of the Hindi keyboard.

Based on the scenario as above, the need for an effective TTS system for Hindi Language is highly felt which implemented to provide an option to the user to input the text either in Devnagri script

or in Romanized English text. For such a system input string comes in form of a Romanized sentence or word (all possibilities considered) apart from the regular Hindi sentence or word, which is further processed to output a synthesized speech.

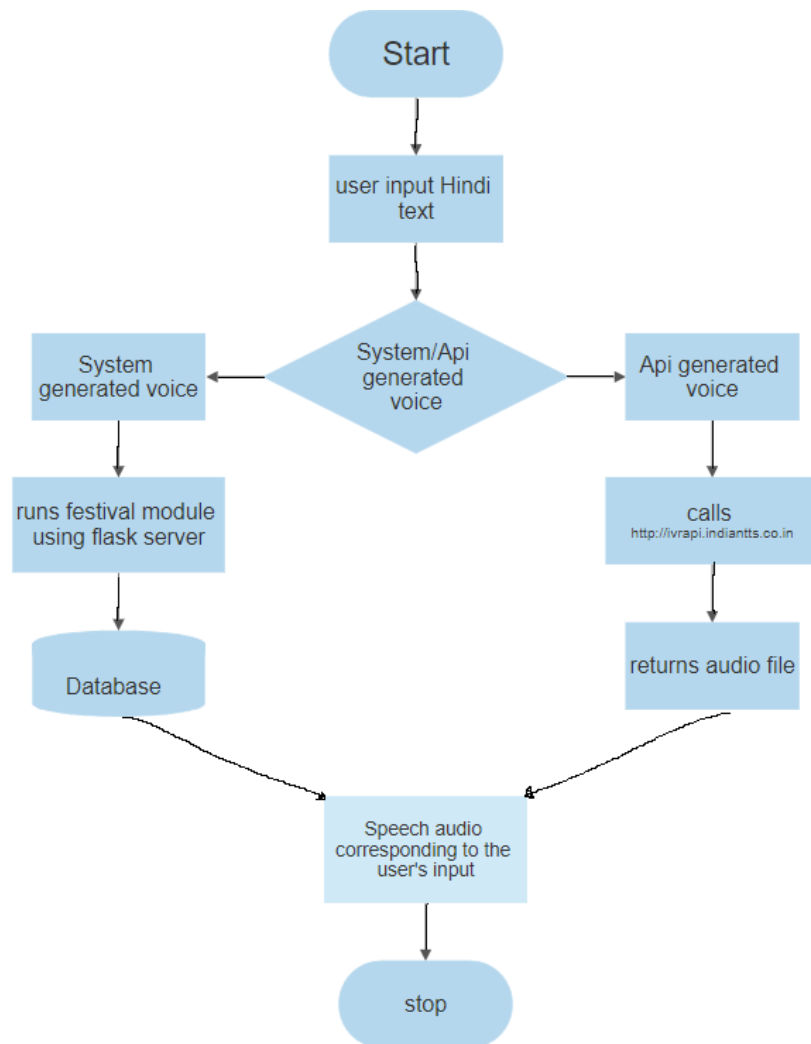


Figure 1: Project flow

## 2 Goals

- Generate system generated Voice of Hindi Text (Male Voice)  
We take the input text from the user in Devanagari fonts and using the festival module we use it's (voice hindi NSK diphone) functionality to generate the voice corresponding to the text entered.
- Generate API generated Voice of Hindi Text (Female Voice)  
We use API of [\[4\]www.indiantts.co.in](http://www.indiantts.co.in) to generate audio corresponding to the input either in Hindi, Hinglish or English language.
- To improve the model using “Transfer Learning”  
We use the Transfer Learning because it allows us to build accurate models in a time-saving way. With transfer learning, instead of starting the learning process from scratch, you start from patterns that have been learned when solving a different problem. This way you leverage previous learnings and avoid starting from scratch.

### 3 Methodology

The TTS for Hindi uses the widely used [3] Festival TTS engine. The text analysis module part converts all non standard words to standard ones. The phonemic analysis module is a grapheme-to-phoneme converter, converting the written text into a sequence of phonemic symbols. The prosodic analysis module then takes the phoneme sequence, and assigns to each phoneme the required pitch and duration. Both the 129 phonemic and prosodic analyses are typically language dependent. Then the final the speech synthesis is performed by using two different concatenative synthesis techniques available in the Festival engine – unit selection and multisyn unit selection. We implemented all the modules using Festival tools.

## 4 DESIGN AND IMPLEMENTATION OF TTS

A text-to-speech system is composed of two parts: a frontend and a back-end. The front-end has two major tasks.

First, it converts raw text containing symbols like numbers and abbreviations into the equivalent of writtenout words. This process is often called text normalization, pre-processing, or tokenization. The front-end then assigns phonetic transcriptions to each word, and divides and marks the text into prosodic units, like phrases, clauses, and sentences. The back-end—often referred to as the synthesizer – then converts the symbolic linguistic representation into sound, by a concatenative approach. The user writes the text either in Devnagri or Romanized script of Hindi language. The written text is processed only in Romanized script but also adaptable for Devnagri script. Such system for Hindi language is only possible when Devnagri is converted to Romanized script. Once the Romanized script is obtained, the task of text analysis and speech generation of TTS system is done. In order to develop a TTS system, the bottom down approach deals with the designing of database.

Preparing a database is the main theme of any TTS system. The database is designed purely on Hindi language but represented in Romanized script for the ease of platform compatibility. The database is formed by preparing various phonemes of Hindi language. A word document is interfaced by the user to write Devnagri script.



## **5 Work Done:**

### **5.1 Web application:**

We have created web application using [1]HTML, JAVASCRIPT, CSS, BOOTSTRAP.

- HTML is used for making Web-page
- JAVASCRIPT is used for API connection of [www.indiantts.co.in](http://www.indiantts.co.in)
- CSS is used for making GUI attractive
- BOOTSTRAP is used for Designing

### **5.2 Server creation using Python Flask:**

[2]Flask is a micro web framework written in Python. It is classified as a micro framework because it does not require particular tools or libraries. It has no database abstraction layer, form validation, or any other components where pre-existing third-party libraries provide common functions.

We used flask for running Festival module in Ubuntu and passing commands.

### **5.3 Training the Festival module using Transfer Learning:**

Transfer Learning is used to train the Festival module using data available online from IIT-Madras.

**FILES:**

1. We have main file entry point server.py (can be run as)

*python3 server.py*

2. Two UI files in folders Static Templates

(a) Static: contains file style.css

(b) Templates: contains file index.html

Link to access data: <https://git.cse.iitb.ac.in/srwarade/Text-to-speech-converter>

## 5.4 Challenges

- We didn't have the text conversion facility which directly converts input text to Hindi text. For this we need to convert the text to Hindi using GOOGLE Translate and then paste it to the input box.

this problem is incurred only for System generated voice and using API we need not to do this conversion.

- We are unable to get enough training data for Hindi to train Festival module, which resulted in Robotic voice as output.
- The system generated voice uses System resources heavily which causes lag in the system resulting in inconsistency.
- The Flask Server in python is storing a file in the drive of the user's input to pass it as input to the Festival module.

## References

- [1] w3schools  
<https://www.w3schools.com>
- [2] Stackoverflow  
<https://www.stackoverflow.com>.
- [3] Festival  
<https://www.festvox.org/festival>
- [4] IndianTTS  
<https://www.indiantts.com>