

# Design and Study of a Text-to-Speech Converter with Language Conversion Using Raspberry Pi

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**Abstract**— This paper deals with the study and designing of a text to speech converter along with a language translator. Its involves details study of back end procedure of a text to speech converter. The system is designed in a way that it can be implemented on hardware as well as a software platform. The software implementation involves study and use of linux operating system where the system is programmed and on the hardware level it uses a raspberry pi board. This module is different from its preexisting models as it displays the input text on the connected monitor and announces the same text in prerecorded sound and it initiates language translations on request for two target languages i.e English to Kannada and English to Hindi.

**IndexTerms**- Linux, raspberry pi, text-to-speech(tts), language conversion, embedded systems

## I. INTRODUCTION

Real time implementation on a text to speech converter has been an area of interest for many real time embedded system developers. Embedded Systems are those systems which are designed to perform many task or just one specific task as per the requirement. In this proposed system the raspberry pi is used as the embedded hardware. The use of a raspberry pi board optimizes the cost of the project as it works as a mini speaker. In our country there exist not just one but many different language which causes a hindrance in communication between two people belonging to two different language zones.

Text to speech conversion on a hardware platform is achieved by using a raspberry pi board, a keyboard is used to give the input text, a monitor that is interfaced to the board which displays the input text and a speaker which gives the output form of the input text. On the software platform the c-code is done on a linux platform where the input command is given. In this paper the proposed system uses vmware workstation software which runs the linux operating system virtually on a windows operating system. The language conversion is done using a look up table method. The source language is given as the input and matched to the corresponding target word in the look up table and then the target language is displayed on the screen. This project can be very helpful to communicate between people belonging to different regions. Majorly its will be useful for individuals who are visually impaired, people with hearing disability and people with verbal disability for an educational purpose or for communication. It can also be used for making announcements or for educational purpose in the institutions. One advantage that this project has above the pre-existing technologies is that it does not need to pre record the sound that need to be played. Whichever text is given as input is given in the audio format.

## II. METHODOLOGY

This proposed module performs two functions:

1. Text-to-speech conversion
2. Language conversion.

### *Text-to-speech conversion*

To reproduce the natural sound in any particular language a series of text in the chosen language is pre recorded which might contain every possible sound. These text may include sounds from poetry, political news, sports stock exchange etc. the prerecorded sounds are the separated and arranged accordingly in an acoustic database and during its creation the recorded speech is further divided into diphones, syllables, morphemes, words, phrases and sentences. A linguistic analysis is done which transports written text into phonetic text. This procedure is carried out by the tts system to reproduce the words from a text. The next step is carrying out a grammatical and a syntactic analysis which helps the system in pronouncing in a sensible manner. This procedure is called prosody which gives rhythm in a sentence. The final step is producing the information that is associated with phonetic writing along with the tone and the length of the pronunciation. After this step all the analysis is completed and the sound is produced.

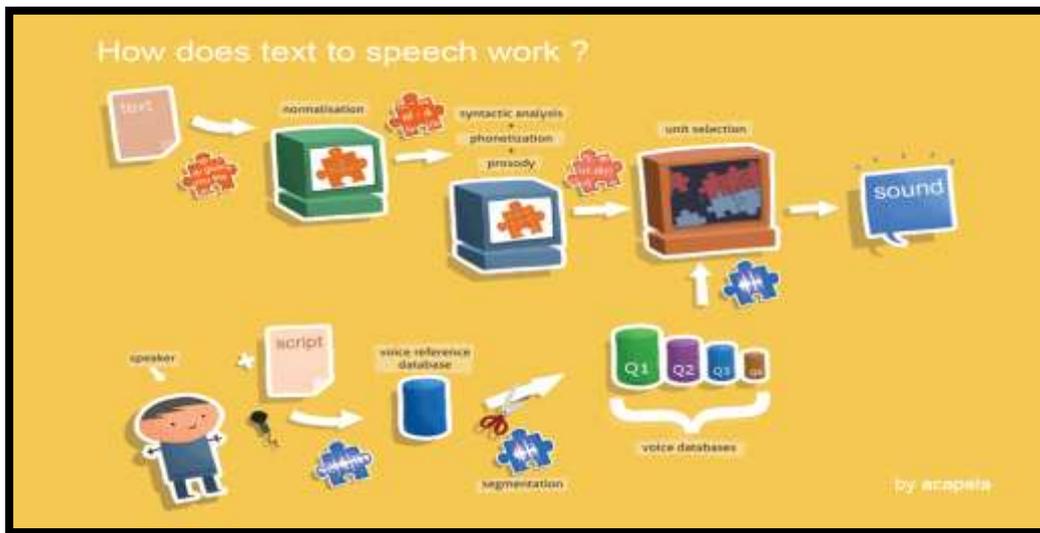


Figure1 . Backend working of a tts system

**Language Converter**

The language conversion part of the project is operated only on the demand of the user. This project provides language conversion between two languages is English to Kannada and English to Hindi. Its involves converting the obtained text into the required target text. This is operated using a look up table method where a dictionary of the words is created in all the three languages. When the input text is given in

English language. The required target language is selected and the corresponding target word is searched in the dictionary. When the target word is matched it is displayed on the screen for the user. The quality of translation can be affected by various factors including the knowledge of the translator of the culture and linguistic pattern of the people of that area.

**III. SYSTEM ARCHITECTURE**

**Proposed Block Diagram**

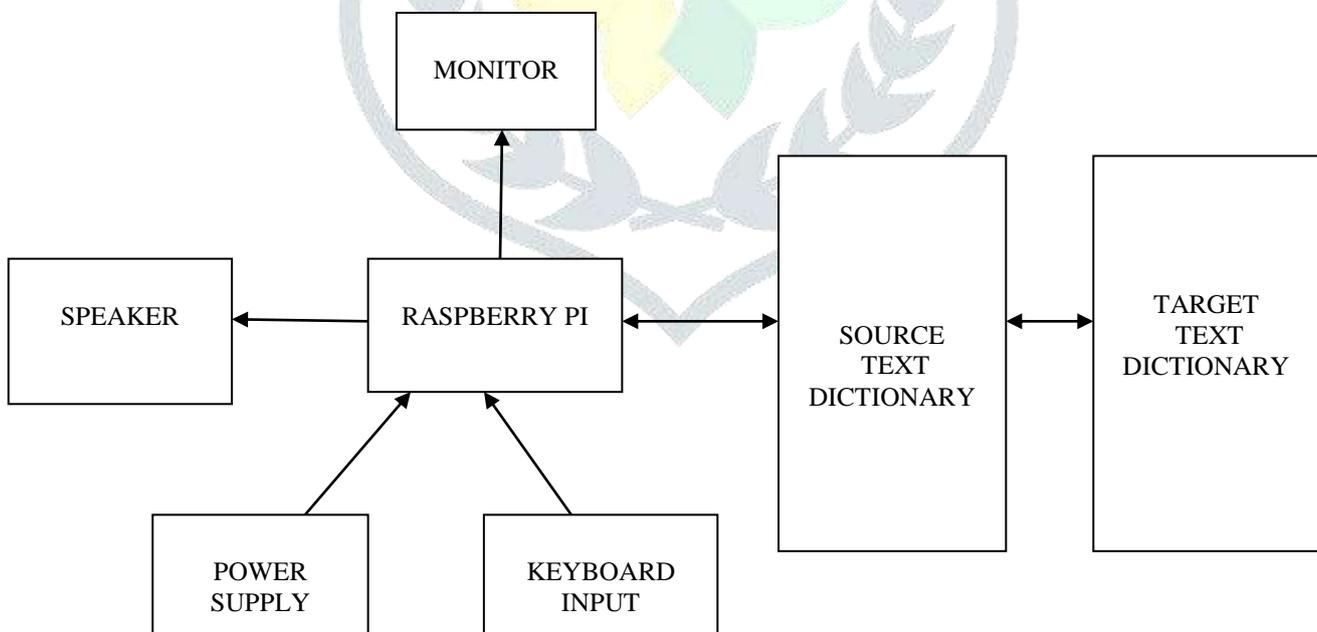


Figure2. Block diagram of the system

In the proposed block diagram for this project the Raspberry pi board is connected to a keyboard which gives the text input to the system by a keyboard which is connected to the USB port on the board. A DC power supply is given. The monitor

which is connected is used as a display. The speaker is connected to give the audio output of the input text. The text dictionary for language conversion is the backend part of the system.

#### IV. SYSTEM OVERVIEW

##### *Raspberry Pi*

The raspberry pi is a credit card sized board which is developed in the United Kingdom by the Raspberry pi foundation. It was developed by the corporation with the purpose to promote basic computer science teaching in schools. It has several amazing features of which the user must be aware before they start implementing.



Figure 3. Raspberry pi processor.

Until now several generation of raspberry pi has been released until now. It very first version was released in February, 2012 and updated versions were released later. All the models of raspberry pi have a Broadcom System on chip (SOC) that includes an ARM compatible CPU and an on chip GPU. The speed of CPU can range from 700 MHz to 1.2GHz and the on board memory ranges from 256MB to 1GB RAM. To store the operating system and the programming code a digital SD card is used. The raspberry pi board has a upto four USB ports, one HDMI port for high definition display.

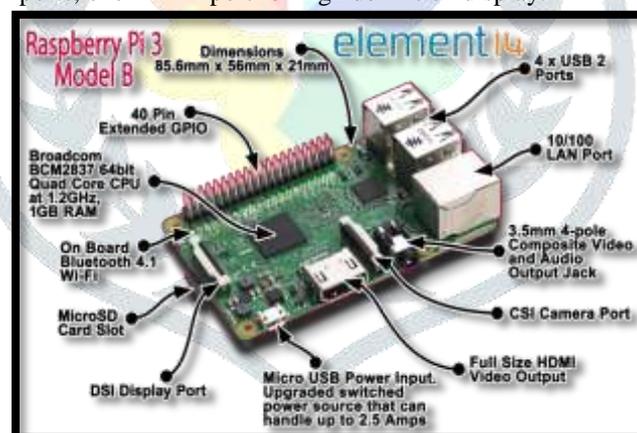


Figure 4. Features of Raspberry Pi

Features of raspberry pi:

- It has an Ethernet port and an on Wifi 802.11 and a Bluetooth module.
- It supports basic programming languages such as Python, Basic, C, C++, Java etc.
- It uses a Broadcom BCM2837 Soc which works on 1.2GHz on a quad-core ARM Cortex-A53 which has a memory of 512KB and a shared L2 cache.
- It supports peripherals like a generic USB computer keyboard and a mouse for its operation.
- The video controller supports standard TV resolutions such as HD and Full HD and even older versions such as CRT TV resolutions.

##### *VMWare Workstation*

VMWare Workstation runs on x64 versions of Windows and Linux operating systems and it is used to setup a virtual environment. It enables to run a virtual machine on a single physical machine along with a pre-existing machine on the same system. Each virtual machine can run versions of Microsoft Windows, Linux and MS DOS. VMWare allows the use of host

network adapters and also enables sharing of physical disk drives and USB devices with a virtual machine. The virtual hard disk drives are implemented as a .vmdk files.

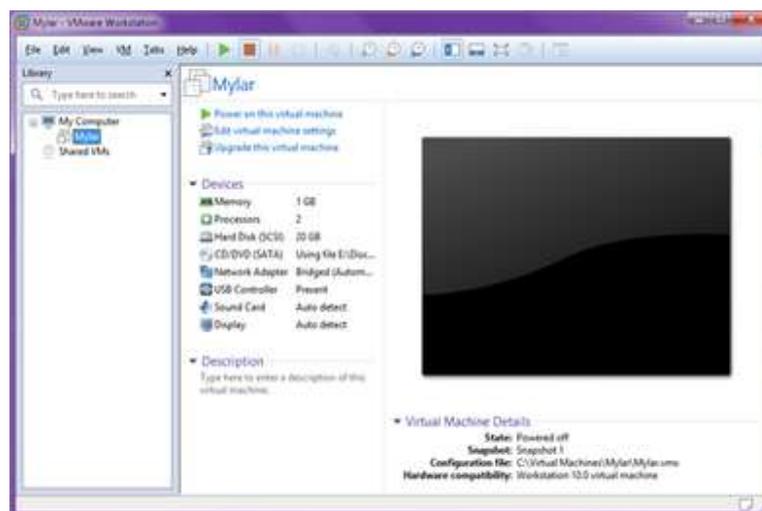


Figure 5. Screenshot of VMWare Workstation

### Ubuntu

Ubuntu is a Debian based Linux operating system. It was developed by a UK based company, Canonical Ltd and based on free software. It was developed on the principle of open-source software development so that it can be freely available to everyone for learning purpose. Ubuntu on installation provides many softwares by default such as LibreOffice, Firefox, Thunderbird etc. System requirements for installation of ubuntu includes a PC which has at least 2GHz dual core processor, 2GB of RAM and 25GB of freehard disk space.

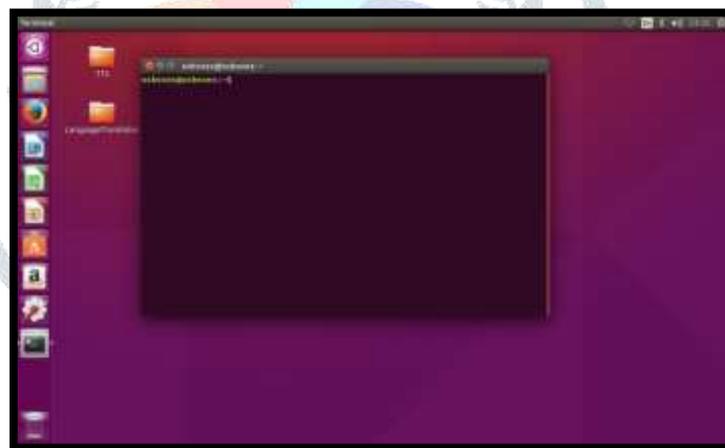
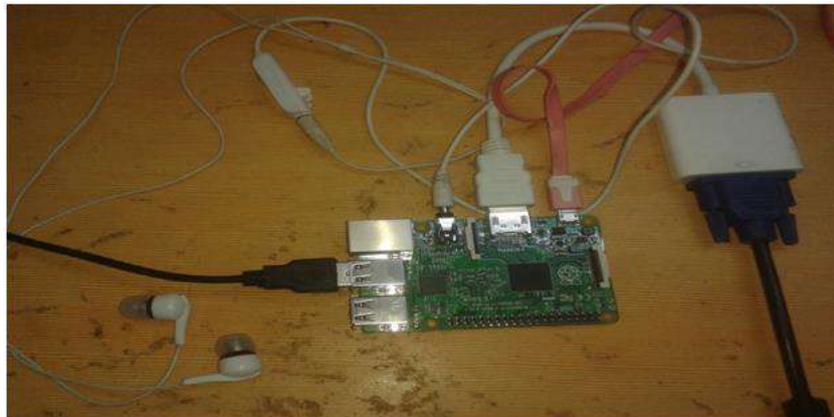


Figure 6. Screenshot of Ubuntu operating system.

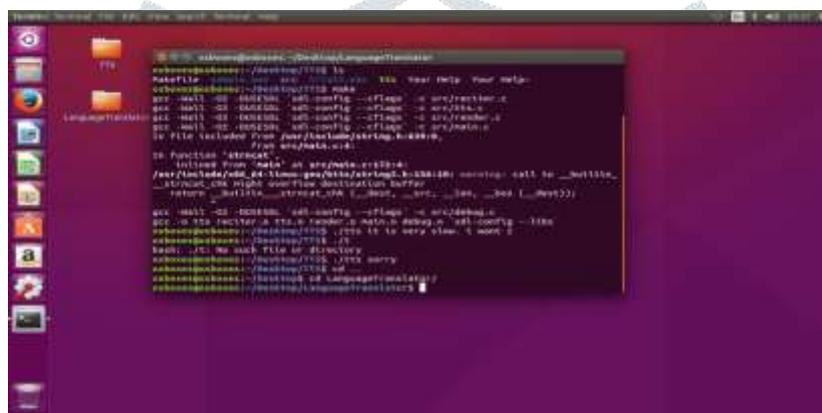
## V. IMPLEMENTATION

For every long time text to speech converter as been a keen area of interest for real time embedded system developers due to its real time applications and this project involves not only text to speech conversion but also language conversion. The code for both the modules are written using c programming language in a linux environment on ubuntu platform. VMWareWorkstation is installed on a windows laptop in which a virtual Linux environment is installed on which the development takes place. This project can also be used only on the software platform without using a hardware board which makes it easy to be used anywhere without the burden of carrying the hardware along with us everywhere. To implement the project on a hardware platform Raspberry Pi processor which is like a mini computer is used. The c-code is uploaded on the processor. A keyboard is connected through the USB port which is used to give the text input to the system. A monitor is connected using the HDMI port to be used as a display. A speaker is connected to the audio port to give the audio of the input text. Raspberry Pi board is based on a ARM Cortex controller and the main aim selecting this is its low power consumption and its high speed of operation and the implementation of text to speech and language conversion is made easier by the SDRAM memory which can store large amount of data. One more advantage is that it supports image sensor interfacing which enables to develop an image recognition system for visually impaired individuals which is the future scope of this project.

**VI. EXPERIMENTAL RESULTS**



**Figure 7. Connections of Raspberry Pi**



**Figure 8. Screenshot of text to speech converter**



**Figure 8. Screenshot of language converter**

**VII. CONCLUSION**

This paper described the implementation of a text to speech converter along with language conversion on a Raspberry Pi processor on a hardware platform and on Linux operating system a software platform. It has many applications because of its real-time response. It bridges the communication gap between two individuals who speak different languages. It can mainly be used by individuals with verbal disability to communicate with people as well as by people who have visual impairment. It can be used in educational institutions to give lectures to students. The notes can be written by the teacher and be pre-recorded and then played at the time of lecture. It can also be used to make announcements in public places.

The future scope of this project is to develop an image recognition along with text to speech converter to help visually impaired individuals for educational purpose.

### VIII. ACKNOWLEDGEMENT

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