**CHAPTER ONE**

**INTRODUCTION**

**1.1 Background of Study**

Machine replication of human functions like reading is an ancient dream. However, over the last five decades, machine reading has grown from a dream to reality. Visually impaired people report numerous difficulties with accessing printed text using existing technology, including problems with alignment, focus, accuracy, mobility, and efficiency.

Globally, it is estimated that at least 2.2 billion people have a vision impairment or blindness, of whom at least 1 billion have a vision impairment that could have been prevented or has yet to be addressed.

This 1 billion people includes those with moderate or severe distance vision impairment or blindness due to unaddressed refractive error (123.7 million), cataract (65.2 million), glaucoma (6.9 million), corneal opacities (4.2 million), diabetic retinopathy (3 million), and trachoma (2 million), as well as near vision impairment caused by unaddressed presbyopia (826 million), (WORLD HEALTH ORGANIZATION, 2020) .

Many people cannot afford eye treatments. To be categorized as blind, there is a complete loss of vision. Blindness cannot be improved by simple visual aids such as glasses. For the indigents, blindness is a drawback. So this paper presents a system to aid blind people.

A Majority of the visually impaired use Braille for reading documents and books which are difficult to make and less readily available. This gives rise to the need for the development of devices that could bring relief to the agonizing tasks that the visually impaired has to go through. Due to digitization of books there are many excellent attempts at building a robust document analysis system in industries, academia and research labs, but this is only for those who are able to see. This project aims to study the image recognition technology with speech synthesis and to develop a cost effective, user friendly image to speech conversion system. This system serves as an electronic book that reads out text to the visually impaired. It is a python program that uses Text To Speech (TTS) method to convert text to audio.

Over the years, there have seen different devices which supports or aids the visually impaired in various forms. Some of which are:

* Image to Speech Conversion for Visually Impaired(International Journal of Latest Research in Engineering and Technology-2017)
* OCR based automatic book reader for the visually impaired using Raspberry PI (International Journal of Innovative Research in Computer and Communication Engineering - 2016)
* A Smart Reader for Visually Impaired People Using Raspberry PI (International Journal of Engineering Science and Computing – 2016)
* Camera based Text to Speech Conversion, Obstacle and Currency Detection for Blind Persons (Indian Journal of Science and Technology – 2016)

Note: this would be discussed more in chapter 2

**1.2 Statement of the problem**

As stated above, there are various devices that have been developed and improved through the years that serve serves as aids to the visually impaired. But none of these serve the purpose of converting a written book to electronic text and convert to audio for reading, making it less difficult and more convenient to access books

However, this project focuses on design and implementation of E-Book with Voice emulation for the visually impaired persons. With this being established, the research therefore tries to answer the following questions.

i Is there any device already built that serves as an E-book for the visually impaired?

ii How beneficial will the device be to the visually impaired?

iii Will the device aid the visually impaired as proposed?

**1.3 Aim and Objectives of the study**

The aim of this project work is to design and implement an electronic book voice emulation using the google TTS Python Module

The specific objectives are to:

i Design an electronic book in which the software would be integrated into.

ii Implement the google TTS module into the system

iii Test the system functionality and making each button perform its functions as expected

**1.4 Significance of Study**

This project seeks to build an electronic book that converts soft complete textbook format to audio format by providing a physical device which could be used to read out the provided input.

This device serves has a reading aid to the visually impaired personnel making it easy to read books. This device target people with issues of presbyopia and other related eye defects.

**1.5 Justification of study**

There is the need to design an electronic equipment that converts text/pdf to audio and reads out this converted text to the user having specific features and functionalities

This justifies the reason for an electronic book in the world today making access to books by the visually impaired 100% possible, convenient and effective

**Scope of the study**

This device is required to serve as a reading aid to visually impaired people. It a electronic book which reads out inputted textbook/book in pdf into the physical device to the visually impaired.

**1.7 Definition of Terms**

iElectronic book readers : Commonly called e-book reader, this is a reading device that converts uploaded text/book/pdf to audio format I using google TTS method and reads the converted text to users

ii TTS: this means text to speech. This is a google text to speech system

iii python: this is a programming language that creates the algorithm that does the task

iv Module: this is an inbuilt framework for python to perform a specific task

V Single Board computer:

**CHAPTER TWO**

**LITERATURE REVIEW**

2.1 OVERVIEW

The eBook publishing industry is rapidly growing. Since the Internet revolution, the 400-year old publishing industry had no choice but to move to the online space in order to satisfy its also growing audience. In consequence, nowadays regular print books from every major publishing house are commonly found in electronic format and the current trend is that more and more are digitized and uploaded to the Internet.

In the 2000s, there was a trend of print and e-book sales moving to the [Internet](https://en.wikipedia.org/wiki/Internet), where readers buy traditional paper books and e-books on [websites](https://en.wikipedia.org/wiki/Website) using [e-commerce](https://en.wikipedia.org/wiki/E-commerce) systems. With print books, readers are increasingly browsing through [images](https://en.wikipedia.org/wiki/Image) of the covers of books on publisher or bookstore websites and selecting and ordering titles online; the paper books are then delivered to the reader by mail or another delivery service. With e-books, users can browse through titles online, and then when they select and order titles, the e-book can be sent to them online or the user can download the e-book.([*"BBC – WebWise – What is an e-book?"*](http://www.bbc.co.uk/webwise/guides/about-e-books) , [*www.bbc.co.uk*](http://www.bbc.co.uk/) – 2007).

By the early 2010s, e-books had begun to overtake hardcover by overall publication figures in the U.S.([*eBook Revenues Top Hardcover –*](http://www.mediabistro.com/galleycat/ebooks-top-hardcover-revenues-in-q1_b53090) 2013)

Many people say they would never read an e-book - they like the feel of a normal book and don’t see why they’d want to give it up. This is reasonable enough, but there are different reasons to read a book.

Some e-readers come with their own wireless internet connection, which allows you to browse and purchase books right on the e-reader itself. You can then take the e-book with you and read it! And once you’re accustomed to the screen, it’s easy to forget you’ve done it electronically.

One downside of an e-book is when you want to lend it to a friend. If you like to lend and borrow books, then you may yet be better off with a good old-fashioned paper-and-ink edition. And if you’re the type who leaves books on the bus, then you probably won’t want to risk doing that with an expensive e-book.

he main reasons for people buying e-books are possibly lower prices, increased comfort (as they can buy from home or on the go with mobile devices) and a larger selection of titles(Bhardwaj, Deepika 2015) . With e-books, "electronic [bookmarks](https://en.wikipedia.org/wiki/Bookmark_(World_Wide_Web)) make referencing easier, and e-book readers may allow the user to annotate pages." he amount of e-book reading is increasing in the U.S.; by 2014, 28% of adults had read an e-book, compared to 23% in 2013; and by 2014, 50% of American adults had an e-reader or a tablet, compared to 30% owning such devices in 2013 (Pew Research, 2014).



*Fig 2.1:* [*iLiad*](https://en.wikipedia.org/wiki/ILiad) *e-book reader equipped with an e-paper display visible in sunlight*

2.3 ELECTRONIC BOOK READERS FOR VISUALLY IMPAIRED INDIVIDUALS

e-books and e-book readers might be all the rage right now and rightfully so, though unfortunately those with physical disabilities could be deprived of all the benefits that the digital version of books can offer. There seems to be just not enough [ebook readers](http://goodereader.com/blog/) out there that those users more pronounced forms of disabilities can make the most of.

Manufacturers of [ereaders](http://goodereader.com/blog/category/electronic-readers) seem least interested in promoting their devices among the disabled which is one of the major motivation of these project.

Howerever there have been some few solutions that have been presented such as ebooks whichincludes using Portable Braille terminals and Text to speech.

2.4. BRAILLE EBOOK

**Braille is a system of raised dots that can be read with the fingers by people who are blind or who have low vision. Teachers, parents, and others who are not visually impaired ordinarily read braille with their eyes. Braille is not a language. Rather, it is a code by which many languages—such as English, Spanish, Arabic, Chinese, and dozens of others—may be written and read. Braille is used by thousands of people all over the world in their native languages, and provides a means of literacy for all.**

The specific code used in the United States has been English Braille, American Edition but as of 2016 the main code for reading material is Unified English Braille, a code used in seven other English-speaking countries (“What Is Braille?

” - www.afb.org )

**Braille** is read by moving the hand or hands from left to right along each line.

Braille display or Braille terminal is an electro-mechanical device for displaying Braille characters, usually by means of raising dots through holes in a flat surface. Blind computer users, who cannot use a normal computer monitor, use it to read text output.



*Fig 2.2: Braille Terminal*

A [**braille**](https://en.wikipedia.org/wiki/Braille)[**e-book**](https://en.wikipedia.org/wiki/E-book) is a [refreshable braille display](https://en.wikipedia.org/wiki/Refreshable_braille_display) using [electroactive polymers](https://en.wikipedia.org/wiki/Electroactive_polymers) or heated wax rather than mechanical pins to raise braille dots on a display. Though not inherently expensive, due to the small scale of production they have not been shown to be economical.

In 1960 Robert Mann, a teacher in MIT, wrote DOTSYS, a software that allowed automatic [braille translation](https://en.wikipedia.org/wiki/Braille_translator), and another group created an [embossing](https://en.wikipedia.org/wiki/Braille_translator) device called "M.I.T. Braillemboss.". The Mitre Corporation team of Robert Gildea, Jonathan Millen, Reid Gerhart and Joseph Sullivan (now president of Duxbury Systems) developed [DOTSYS III](https://en.wikipedia.org/w/index.php?title=DOTSYS_III&action=edit&redlink=1), the first braille translator written in a portable programming language. DOTSYS III was developed for the [Atlanta Public Schools](https://en.wikipedia.org/wiki/Atlanta_Public_Schools) as a [public domain program](https://en.wikipedia.org/wiki/Public_domain)(A[*nn S. Schack and R.T. Mertz, 1961*](http://www.duxburysystems.org/downloads/library/history/1961_ibm.pdf)). Braille translators allowed the automatic creation of braille text or books from an script into Braille scripture without the need of typing Braille books in Braille typewriters, but still needed embossers to produce books, this last step is not necessary when the e-book is read in a Braille e-book.

A Korean [concept design](https://en.wikipedia.org/wiki/Concept_design) published in 2009 by Yanko Design attracted attention. A British prototype design called "Anagraphs" was created in 2013, but funding from the European Union ran out before it could be brought to production(BBC News, 8 May 2014).

A Braille Ebook/Tablet was slated to be released for purchase in the 4th quarter of 2016 by the Austrian company Blitab. It was expected to be priced under US$3000. As of February 2019 the company was inviting people to sign up as a "Tester", with the explanation, "Become one of the first to touch and feel the future of large scale tactile Braille displays." ([BLITAB website, "Contact us" section](http://blitab.com/" \l "contact), accessed 2019-02-13.)



*Fig 2.3:* The concept design of a braille e-book

2.5 TEXT TO SPEECH TECHNOLOGY

Text-to-speech systems, also known as TTS, were first developed to aid the visually impaired by offering a computer-generated spoken voice that would “read” text to the user.

TTS software in general is considered an [assistive technology tool](http://online.alvernia.edu/5-assistive-technology-tools-that-are-making-a-difference/) that can be used in many ways. Another early application of this technology was to help people who have trouble reading. The amendment of the Individuals with Disabilities Education Act (IDEA) in 2004 compelled educational institutions to seek out technology to assist in fulfilling this mandate. The IDEA is a federal law ensuring educational services to children with disabilities throughout the United States.

TTS allows users to see text and hear it read aloud simultaneously. There are many apps available, but typically as text appears on the screen, it’s spoken. Some software uses a computer-generated voice and others use a recorded human voice. Very often the user has a choice of gender and accent as well.

Tablets and smartphones usually have built-in text-to-speech features. The software reads text files, and the names of programs or folders when pointed at on the screen and can read certain web pages aloud.

Text-to-speech tools are often used with [optical character recognition (OCR)](https://www.abbyy.com/en-ca/finereader/about-ocr/what-is-ocr/). OCR is a technology that scans printed material into a computer or handheld unit and converts it to digital text. There are also portable OCR devices available. These are called [reading pens](http://learningabledkids.info/assistive-technology/assistive_technology_reading/reading-pen-assistive-technology-for-dyslexia-and-reading-disabilities/), and they can scan and read back text. Most digital devices include apps that read digital books.

While text to speech has benefits for all users, some specific groups benefit more than others.

People with learning disabilities who have difficulty reading large amounts of text due to dyslexia or other problems really benefit from TTS, offering them an easier option for experiencing website content.

People who have literacy issues and those trying to learn another language often get frustrated trying to browse the internet because so much text is confusing. Many people have difficulty reading fluently in a second language even though they may be able to read content with a basic understanding. TTS technology allows them to understand information in a way that makes content easier to retain.

TTS allows people to enjoy , and also provides an option for content consumption on the go, taking content away from the computer screen and into any environment that’s convenient for the consumer. For people with visual impairment, text to speech can be a very useful tool as well. For those who access content on mobile devices, reading a great deal of content on a small screen is not always easy. Having text-to-speech software doing the work is much easier. It allows people to get the information they want without the inconvenience of a lot of scrolling.

TTS offers many benefits for content owners and publishers as well. This feature immediately increase the accessibility of online content for those with visual impairments or reading difficulties and it facilitates access for a larger percentage of the online population, including those whose native language is different from the language of a particular website or mobile app.

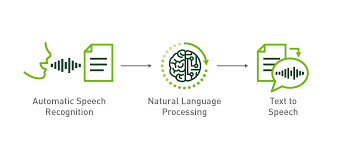
Text-to-Speech makes it easier in general for all people to access online content on mobile devices, increases citizen engagement and strengthens corporate social responsibility by ensuring that information is available in both written and audio format.

Text-to-speech (TTS) is a type of  [assistive technology](https://www.understood.org/en/school-learning/assistive-technology/assistive-technologies-basics/assistive-technology-what-it-is-and-how-it-works) that reads digital text aloud. It’s sometimes called “read aloud” technology.

With a click of a button or the touch of a finger, TTS can take words on a computer or other digital device and convert them into audio. TTS is very helpful for kids who [struggle with reading](https://www.understood.org/en/learning-thinking-differences/child-learning-disabilities/reading-issues/understanding-your-childs-trouble-with-reading). But it can also help kids with writing and editing, and even focusing.

TTS works with nearly [every personal digital device](https://www.understood.org/en/school-learning/assistive-technology/assistive-technologies-basics/assistive-technology-platforms-what-you-need-to-know), including computers, smartphones and tablets. All kinds of text files can be read aloud, including Word and Pages documents. Even online web pages can be read aloud.

The voice in TTS is computer-generated, and reading speed can usually be sped up or slowed down. Voice quality varies, but some voices sound human. There are even computer-generated voices that sound like children speaking.



*Fig 2.4:* Text to speech

2.5.2 APPLICATIONS OF TTS

Businesses, Organizations, and Publishers that integrate TTS technology benefit from:

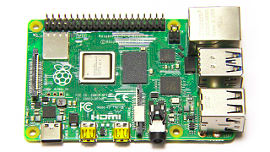
* **Enhanced customer experience** – Speech-enabling pre- and after-sales service minimizes human agent workload, provides personalized services, accelerates throughput, and reduces operational costs.
* **Effective branding across touchpoints** – A single TTS voice across multiple contact points supports consistent, emotional branding.
* **Global market penetration** – clear, lifelike, and customizable TTS voices from around the world extend the reach of your business.
* **Optimized development and maintenance** – Robust TTS technology that supports the most widespread platforms, is available both in the cloud and on premises, and is scalable according to actual business needs, saves development and maintenance efforts.
* **More autonomy for the digital content owner** – Many think that text-to-speech software is something to be downloaded manually. It can be, but there are cloud-based forms, or Software as a Service (SaaS). With a few simple lines of code, the audio is generated instantly and for new or updated content, the spoken version is updated automatically.
* **Increased web presence** – Websites with TTS technology attract some of the [774 million people worldwide with literacy issues](http://uis.unesco.org/en/topic/literacy) and the [285 million people with visual impairments](http://www.who.int/mediacentre/factsheets/fs282/en/). Also, speech enabling web content does not interfere with usability for those without disabilities. It actually aids all other populations, including older users and foreign/non-native speakers.
* **Saved time and money** – With TTS technology that is web- or cloud-based on a SaaS (Software as a Service) platform, online content can quickly and easily be speech enabled, and maintenance is minimal.
* **Easier implementation with Internet of Things (IoT)** – The IoT is becoming a critical factor in digital business transformation. Companies across all verticals have digital marketing strategies in place and focus on engaging customers across various connected channels to optimize how they interact with them. TTS gives connected devices in the IoT a more user-friendly way to communicate with consumers.
* **Word-of-mouth marketing** – Adding an alternative way to consume content online enhances the user experience. Visitors are far more likely to return to and recommend websites where they have had positive experiences. And even in our age of social media marketing, word of mouth is still the most important platform, [according to Forbes](https://www.forbes.com/sites/kimberlywhitler/2014/07/17/why-word-of-mouth-marketing-is-the-most-important-social-media/" \l "6555622154a8).
* **Enhanced employee performance with** [**corporate learning**](https://www.readspeaker.com/learning/corporate-learning/) **programs** – With TTS technology, HR departments and e-learning professionals can make learning modules and employee training much easier for employees to learn anywhere and at anytime.

Text to speech has benefits for everyone and here are some points that break down how specific groups see a better user experience:

* **Extend the reach of your content** – TTS gives access to your content to a greater population, such as those with literacy difficulties, learning disabilities, reduced vision and those learning a language. It also opens doors to anyone else looking for easier ways to access digital content.
* **Accessibility is relevant** – Did you know that 15-20 percent of the worldwide population has some form of language-based learning disability? Did you know that 14 percent of adults in the US are illiterate and many have only basic reading skills? Making your online content audible helps the online population to better understand the text. The text is read and highlighted simultaneously so that the reader may easily follow along.
* **Populations are evolving** – 244 million people are foreign born across the globe (an increase of 70 million since 2000). Language proficiency and schooling in the host country’s language is a very real problem for migrants and their families.
* **A growing elderly population depends on technology** – Between 2015 and 2030, the number of people aged 60 years or over will grow by 56 percent, from 901 million to 1.4 billion (Source: www.un.org). In the US alone, 59% of senior citizens use the Internet daily. Making digital content on the Internet accessible in multiple forms creates an easier user experience.
* **People are increasingly mobile and looking for convenience** – In the US, a growing share of time spent on digital content is on mobile devices and the demand for connected devices continues to rise on a worldwide scale. Text to speech can turn any digital content into a multimedia experience and people can listen to a news or blog article, a PDF document, or an e-book on the go!
* **People with different learning styles** – Some people are auditory learners, some are visual learners, and some are kinesthetic learners – most learn best through a combination of the three. Universal Design for Learning is a plan for teaching which, through the use of technology and adaptable lesson plans, aims to help the maximum number of learners comprehend and retain information by appealing to all learning styles.

2.6 SINGLE BOARD COMPUTERS

|  |
| --- |
| Single board computers (SBCs), such as the [**Raspberry Pi**](https://www.youtube.com/playlist?list=PL2m2YvnrOYxLP-pf-4wUvmfDIQVLbbhwv), are small computing devices that can be used for a variety of purposes that include experimentation, learning how to program, building a media player or NAS drive, [robotics](https://www.explainingcomputers.com/rasp_pi_robotics.html) and [home automation](https://www.explainingcomputers.com/pi_automation.html), and performing computing tasks such as web browsing or word processing. SBCs are also increasingly used for a wide range of industrial applications in areas that include robotics and the Internet of things (IoT). |



*Fig 2.4: Raspberry pi*

2.6.2 RASPBERRY PI

Raspberry Pi is the name of a series of single-board computers made by the [Raspberry Pi Foundation](https://www.raspberrypi.org/about/), a UK charity that aims to educate people in computing and create easier access to computing education.

The Raspberry Pi launched in 2012, and there have been several iterations and variations released since then. The original Pi had a single-core 700MHz CPU and just 256MB RAM, and the latest model has a quad-core 1.4GHz CPU with 1GB RAM. The main price point for Raspberry Pi has always been $35 and all models have been $35 or less, including the Pi Zero, which costs just $5.

All over the world, people use Raspberry Pis to learn programming skills, build hardware projects, do home automation, and even use them in industrial applications.

The Raspberry Pi is a very cheap computer that runs Linux, but it also provides a set of GPIO (general purpose input/output) pins that allow you to control electronic components for physical computing and explore the Internet of Things (IoT).

The Raspberry Pi operates in the open source ecosystem: it runs Linux (a variety of distributions), and its main supported operating system, Raspbian, is open source and runs a suite of open source software. The Raspberry Pi Foundation contributes to the Linux kernel and various other open source projects as well as releasing much of its own software as open source.

Some people buy a Raspberry Pi to learn to code, and people who can already code use the Pi to learn to code electronics for physical projects. The Raspberry Pi can open opportunities for you to create your own home automation projects, which is popular among people in the open source community because it puts you in control, rather than using a proprietary closed system.

In this project, we have decided to use a raspberry pi as the main brain that pwers the device

**Refereces**

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