An Assistance System for Deaf, Dumb, Blind, and Learning Disability Individuals

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Abstract - There is always some kind of barrier to impaired individuals in performing daily chores. It is difficult for them to perform and carry out even the simplest of tasks with ease. Whether it may be reading, writing, communicating, or studying, it becomes an impossible job for them to execute. Systems are separately designed for people with different types of impairments, but there lacks a system that can solve all problems as a whole. The purpose of our research work is to create one single system which is able solve all issues for deaf, dumb, blind, and learning disability individuals, which is not only simple to use but also provides accurate results. By using the developed system, people with different disabilities can perform simple daily activities with much ease than before. The developed system, which is a website, helps impaired individuals to read, write, communicate, etc. through various application programming interfaces (APIs).

*Key Words***:** Assistance system, application programming interface, deaf, dumb, blind, learning disability

1.INTRODUCTION

According to the World Health Organization (WHO), a disabled person is anyone who has "a problem in body function or structure, an activity limitation, and has a difficulty in executing a task or action; with a participation restriction"[1]. Any physical or state of mind (weakness) that makes it harder for an individual with the condition to embrace specific undertakings (movement limit) and interface with the climate around them is alluded to as an inability (cooperation limitations).The absence of or significant change in the substantial construction or capacity of an individual and furthermore their mental functioning,can be utilized to portray the term impedance. Brain structure complications and issues may cause inability to perform well mentally, while visual or hearing difficulties can result from abnormalities with the ocular or aural structure. The impairments can either be functional or structural. There are over 1 billion handicapped persons worldwide with 20% of them having severe functioning impairments.

1.1 Hearing Disability

A disability in hearing can be considered when a person can not hear properly.It is characterized as the powerlessness to hear as well as somebody with ordinary hearing-hearing limits of 20 dB or better in the two ears.Gentle, moderate, serious, or significant hearing misfortune are on the whole prospects. It affects one or both hearing, making conversational speech and loud sounds difficult to understand. Most people who are named as "hard of hearing" have significant hearing misfortune, and that implies they have very little or no meeting. ~2.5 billion people are expected to suffer hearing loss by 2050 with at least 700 million requiring hearing rehabilitation[2]. Because of perilous listening propensities, ~1 billion youthful people are at a gamble of irreversible, preventable hearing misfortune. People with hearing disabilities frequently communicate via sign language. In any case, it becomes challenging for an ordinary individual to speak with an individual with hearing misfortune. This is because the normal person can hear the speech from a deaf person, but the person with hearing disability cannot hear the speech of a normal person. In addition, a normal person is unaware of sign language that has to be used while communicating with deaf people. This may affect smooth communication. Although the person is deaf, he/she is able to see. So, when a normal person speaks with a person with hearing disability, our assistance system performs speech to text conversion with the help of an API. The voice of a normal person is converted into text and is read by a person with hearing disability and hence can act accordingly.

1.2 Speaking Disability

When a person has trouble articulating words, he or she may be suffering from speech impairment. Spoken difficulties are defined as the inability to appropriately or fluently create or organize speech sounds and syllables. The term "speech impairments" refers to a wide range of speech abnormalities. A speech, voice, or language issue affects over 18.5 million people in the world. People with speaking disabilities do communicate with sign language like those with hearing disability using hand gestures. Again, a normal person is unaware of this sign language, and he/she is unable to recognize the gestures shown by a normal person through his/her hand. Hence, communication is unclear. Instead of making hand gestures and using sign language, a person with a speaking disability will use the assistance system. The person with a speaking disability will type in a sentence in our system whatever he/she wants to tell to a normal person. Our system will then convert that text into speech. The normal person will be able to hear it and understand what the person with speaking disability wanted to convey.

1.3 Vision Disability

The term "blindness" refers to the inability to see. A blind person cannot see anything. Blindness, in its strictest meaning,

refers to a state where the view of a person is entirely black, and he or she is incapable of distinguishing darkness and light through their vision. Our society has redefined the terms blind and blindness to encompass a wide spectrum of visual impairments. Today, the term "blindness" is commonly used to denote serious vision loss in one or both eyes with some residual eyesight. People with visual impairments are referred to as "partially sighted," "poor vision," "legally blind," and "completely blind." 300 to 400 million individuals worldwide are visually impaired due to a variety of factors. ~50 million people in this category are completely blind, unable to sense light in either eye[3]. A person with visual impairment cannot see. It becomes difficult for them to read any article, books, webpages, etc. By using the assistance system, it makes it possible for them to overcome this difficulty. The system scans the text and converts that text into sound so that a person with visual impairment can eventually hear the sound. Consequently, a visually impaired person is able to read the text without actually reading the text.

1.4 Learning Disability

A learning handicap is a neurological problem that disables the capacity of the cerebrum to send, get, and process data. Perusing, composing, talking, tuning in, getting numerical thoughts, and general cognizance might be trying for a young person with a learning inability.Understanding that the quantity of mind debilitate youngsters at an essential level is expanding and their inabilities in perusing, composing, and math can prompt learning handicaps, research accepts there is a not kidding call to help them in working on their abilities. This is truly significant on the grounds that neglecting to have great essential abilities can diminish the capacity in accomplishing schooling at more elevated levels. The primary goal of this examination work is to propose a help framework for youngsters experiencing learning disabilities. Thus, in this "Learning Disability" section, there are some topics like writing and mathematics skills. In the writing skills part, a person will see two boxes on the screen, the first box will by default contain a particular word or a letter the person has to write the same word in the second input box. If the words in both the boxes match, then the system will print "Nice! You Got it Right", and if a person fails to write the same word from the first box to another, then the system will print "String does not match. Please try again!". Now, in the mathematics section, to improve the math ability of a person, there would be four mathematical operations, namely addition, multiplication, subtraction, and division. The screen will display basic mathematical problems; the person suffering from learning disability has to solve and choose the correct option.

2. LITERATURE REVIEW

Karmel, Sharma, and Garg [4] developed a single device solution that was simple, quick, accurate, and cost-effective. The device's major goal was to help differently abled persons feel self-sufficient and confident by seeing, hearing, and speaking for them. For the blind, deaf, and dumb, their developed system used Google API and Raspberry Pi.

Rahim *et al.* [5] confirmed the theory on dyslexia in terms of definition, characteristics of people with dyslexia, particularly children, learning style of dyslexia children, and identification of appropriate and effective learning materials for dyslexia children by conducting field research at selected schools and associations.

Kumar, Jain, and Kumar [6] explicated that the entire development of comfort technologies revolves around the idea of ease of use, replacing old capacitive buttons with voice as a trigger. It is uncommon for developers to think about those who do not share the luxury of speaking and rely on their hands for communication.

Purushotham, Hitesh, and Dhiki [7] developed a system that allows deaf and hard of hearing people to connect with the rest of the world using sign language. Communication is crucial for humans. Communication is viewed as a skill that can be learned. With these ideas in mind, the authors developed a system that primarily assisted speech-impaired and paralyzed patients.

Pallavi, Amrita, Pranitha, Darshini, and Paramesh [8] developed a system that aimed to provide a social obligation by improving the usability of Android applications for deaf and dumb people so that they can have a normal communication experience using these devices. One such instance was "Nirvatha Vadathi, Nirvatha Vadathi, Nirvatha Vad Vadathi Nirvatha" (silence speaks) is an Android software that allows deaf and hard of hearing persons to converse with normal people.

Kanwal *et al.* [9] developed an application, i.e., dubbed vocalizer to mute (V2M) that employed automatic speech recognition (ASR) technology to recognize deaf-mute speech and transform it into a recognizable form for a normal person. Mel frequency cepstral coefficients (MFCC)-based features for each training and testing sample of deaf-mute speech were extracted in this study.

Pillai, Padmavathy, and Nasrin [10] proposed a deep learning approach to intelligent gesture recognition system for deaf, dumb, and blind communication using k-NN on TensorFlow. Through the proposed approach, ideas included organizing and actualizing a framework using artificial intelligence, image preparation, and data mining to receive contributions as hand signals and provide recognizable returns as content and voice with $\geq 95\%$ accuracy.

Sarkar and Gade [11] developed a system that uses skin detection and morphological procedures to recognize static hand movements. A user does not need to wear hand gloves or any other sensing equipment to minimize the system's complexity and make it more natural and user-friendly.

3. PROPOSED SYSTEM

3.1 Hearing Disability

a. A normal person speaks.
b. The speech is recorded into the system.
c. The system converts it into text and displays it on the screen.
d. The person with hearing disability reads the text and speaks accordingly.
e. The normal person hears it and speaks again.

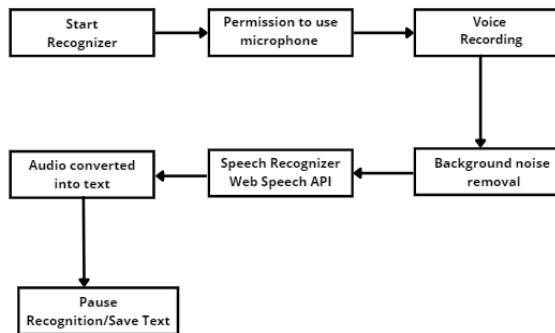In this way, a smooth communication will take place successfully between a deaf and normal person.

Fig -1: Block diagram of hearing disability section

3.2 Speaking Disability

   a. A normal person speaks.
   b. A person with a speaking disability hears the speech of a normal person.
   c. He/she types the text in the system that he/she wants to tell the normal person, i.e., reply back to let the communication take place.
   d. The system converts text to speech.
   e. The normal person hears the speech converted by the system and replies accordingly.
   f. The person with a speaking disability will again type to reply back.

Therefore, a person with a speaking impairment and a normal person will be able to communicate effectively.
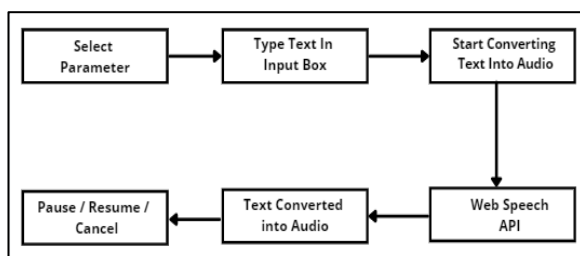

Fig -2: Block diagram of speaking disability section

3.3 Vision Disability

   a. Access webcam and allow permission to sight to use camera for image capturing.
   b. Capture image by clicking the space button.
   c. Optical character recognition (OCR) reconciliation is utilized for robotizing information extraction from printed or composed text from an examined report or picture record and afterward changing over the text into a machine-meaningful structure[12].
   d. Then, this machine-readable form, i.e., text is converted into audio using speech synthesis, which is a computerized voice that turns a written text into a speech—known as text to speech integration.
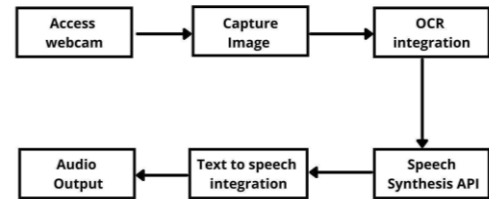

Fig -3: Block diagram of vision disability section

3.4 Learning Disability

   a. Selects one of the options, viz., writing or mathematics skills.
   b. If writing skills, then type the displayed string in the dialogue box given below it.
   c. If the typed string matches with the input string, then an output message is displayed stating the task to be successfully completed otherwise not.
   d. If mathematics skills, then select an appropriate answer from the given option.
   e. If the answer is correct, then the next problem will be displayed otherwise not.

4. CONFIGURATION

4.1 Software Requirements

   a. Operating System - Windows 7 and above
   b. Browser - Chrome
   c. Visual Studio Code
   d.Processor: Intel(R) Core(™) i3 and above-7200U CPU @ 2.50GHz 2.70 GHz

4.2 Hardware Requirements

   a. Camera : Max Resolution 720p
   b. Microphone
   c. Speaker
   d. Screen

5. TECHNOLOGY STACK

5.1 Programming Languages

   a. HTML

HTML is a shortening which addresses Hyper Text Markup Language which is used for making site pages and web applications. We should find out what is implied by Hypertext Markup Language, and Web page.Hyper Text: HyperText just signifies "Text inside Text." Markup language: A markup language is a script that is utilized to apply design and organizing shows to a text record. A page is a record which is ordinarily written in HTML and deciphered by an internet browser. A site page can be distinguished by entering a URL. A Web page can be of the static or dynamic sort. With the assistance of HTML no one but, we can make static website pages[13].

b. CSS

Cascading Style Sheets - or CSS - is the principal innovation you ought to begin using after HTML. While HTML is utilized to characterize the design and semantics of your substance, CSS is utilized to style it and spread it out. For instance, you can utilize CSS to change the text style, variety, size, and dividing of your substance, split it into different segments, or add movements and other enlivening highlights[14].

c. JavaScript

JavaScript is a scripting language that empowers you to make powerfully refreshing substances, control interactive media, enliven pictures, and basically all the other things[15].

5.2 Application Programming Interface (API)

a. Web Speech API

The Web Speech API, permits web engineers to give speech information and text-to-speech yield highlights in an internet browser.The actual API is skeptic of the hidden discourse acknowledgment and combination execution and can uphold both server-based and client-based/implanted acknowledgment and amalgamation.

b. Speech Synthesis API

Speech Synthesis API is a subset of Web Speech API and is an exceptionally well known method for adding voice to a website page or a blog. It empowers engineers to make regular human discourse as playable sound. Erratic strings, words, and sentences can be changed over into an individual recounting exactly the same things[16].

c. OCR Integration

Optical character recognition (OCR) reconciliation is utilized for robotizing information extraction from printed or composed text from an examined report or picture record and afterward changing over the text into a machine-meaningful structure

6. RESULTS AND DISCUSSION

6.1 Sign-in page and welcome page

You will need your email and password to sign in. Welcome page consists of credentials like about us, contact, home, and four radio buttons to choose disability accordingly.
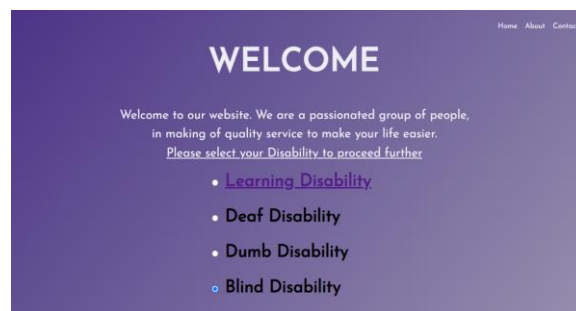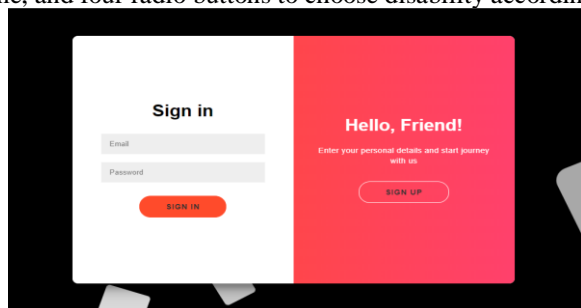

Fig -4: (a) Sign-in page; (b) Welcome page

6.2 Learning disability section

This section consists of two parts: first is writing skill to develop writing and word understanding ability, and the second is mathematical part to develop basic math operations solving ability, which consist of addition, subtraction, multiplication, and division.
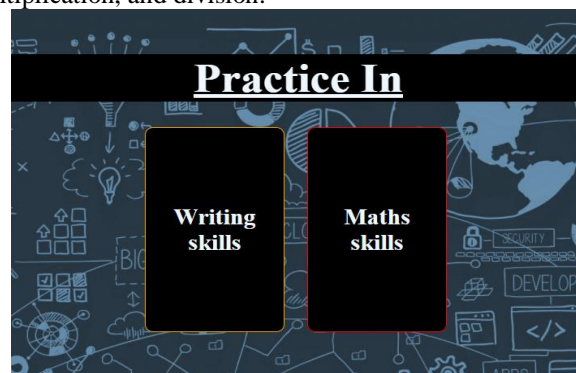

Fig -5: Webpage of learning disability section

6.3 Dumb and deaf section

Herein, in the dumb section, text is converted into audio. It consists of several voice packages like Microsoft David, Microsoft Zira, Google UK English Male, Google UK English Female. etc. We can also regulate or control volume, rate, and pitch accordingly. In the deaf section, speech is

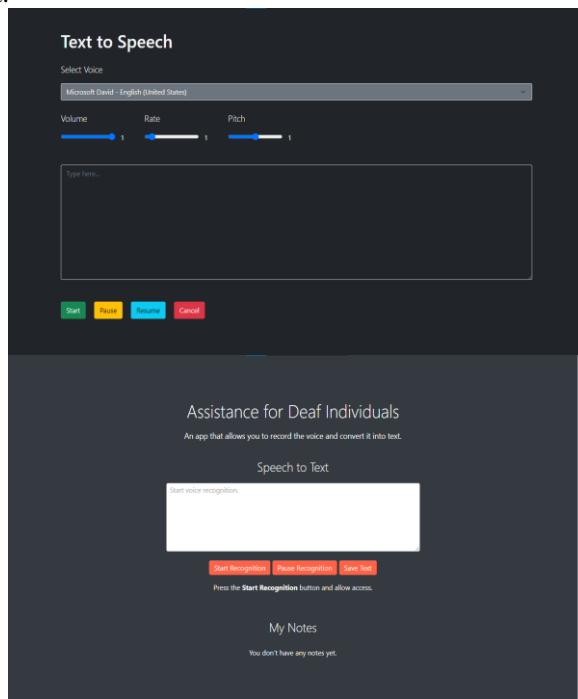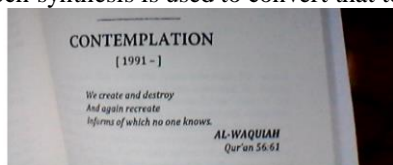converted into text. It also consists of features like to save the text.

Fig -6: Webpage of dumb and deaf section

6.4 Blind section

Herein, a camera is used to capture images. OCR is used to obtain machine-readable text from an image, and speech synthesis is used to convert that text into speech.

Fig. 7: Webpage of blind section

5. CONCLUSION

The primary extent of this study is to make distinctively-abled and learning incapacity people consider themselves independent and confident by learning, hearing and talking using our system. Through this research work, an innovative prototype will be developed to assist persons with various disabilities. This research work not only focuses on developmentally disabled people through promoting and assisting them but also is concise as well as resource efficient as one solution can be found to four problems under a single roof. It has become a concern to think about the growth and well-being of differently abled people, and so, this application could be quite useful in addressing one of the several issues that differently abled people confront.

6. FUTURE WORK

As our study focuses on disabilities like deaf, dumb, blind, and learning, we can also work on mental illness like depression, anxiety, and insomnia. There are many people around the globe who suffer from stress and mental depression. They are traditionally treated while some receive services of psychotherapy. Despite this, as many as 50% of the mentally depressed population does not receive any treatment. The causes for this apparent gap between problem and therapy are unknown, although they include impediments to care such as insufficient insurance coverage and therapeutic limitations. We can develop an online system wherein many of these issues can be solved. An individual suffering from depression can do self assessment, tutorials which are interactive can be designed to guide them and develop antidepressant abilities such as cognitive reorganization. As a result, it resembles an interactive pamphlet rather than a simulation of live treatment. This neglected component of the service sets it apart from other online platforms where mental health experts perform one-on-one psychotherapy or where Patients are counseled via email dialogues. Also, for the blind section, we can add an object detection system that will permit a user to locate objects and make decisions accordingly. In the near future, the website can be developed as a mobile application for easy access and usability.

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