JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

SMART GLASS FOR INDIVIDUALS WITH HEARING IMPAIRMENT

K M Amshumanth
Dept. of Electronics & Communication
K.S. Institute of Technology, Raghuvanahalli,
Kanakapura Road, Bengaluru

Kiran V Narayan
Dept. of Electronics & Communication
K.S Institute of Technology , Raghuvanahalli,
Kanakapura Road, Bengaluru

Kumar K G
Dept. of Electronics & Communication
K.S. Institute of Technology, Raghuvanahalli,
Kanakapura Road, Bengaluru

Mohan Krishna K
Dept. of Electronics & Communication
K.S Institute of Technology , Raghuvanahalli,
Kanakapura Road, Bengaluru

Dr. Sudarshan B
Professor, Dept. of Electronics & Communication
K.S. Institute of Technology, Raghuvanahalli,
Kanakapura Road, Bengaluru

I. ABSTRACT

Smart glasses is a wearable device, specifically smartglasses, designed to facilitate real-time speech translation and transcription. The device includes a head-mounted display that displays the translated text, a microphone for recording audio, and a translator for translating. When it is connected to the Internet, it uses a translation engine and can be configured via a mobile phone. smartglasses aim to enable seamless communication between people speaking different languages, so separate translation devices are not required. Its compact and portable design offers a practical solution for real-time language translation that can be useful for the deaf or hard of hearing. The device uses machine learning, automatic speech recognition (ASR), natural language processing and the Internet of Things to deliver a low-latency solution that demonstrates its potential to improve accessibility for the hearing impaired.

Keywords: ASR, DHH, AR, Smartglasses.

II. INTRODUCTION

The study explores the advances and challenges of automatic speech recognition (ASR) technology, particularly its usability in the Deaf and Hard of Hearing (DHH) community. Despite significant improvements in ASR accuracy, DHH speech, which varies widely between individuals, presents a unique challenge. The study provides an in-depth analysis that goes beyond previous studies and evaluates improvements in Word Error Rate (WER) when using ASR with adapted language models. The results show that despite technical advances, the usability of ASR for the DHH population remains a challenge due to the specific nature of DHH speech. Recognizing the need for access services for the DHH community, the paper addresses the limitations and challenges of using such services. Often, inadequate infrastructure and processes hinder the accessibility of housing, making it expensive or unaffordable. The study highlights the case of a DHH student in the classroom and highlights the difficulties in accessing translation or subtitling services, especially when the lecturer is on the move or attending a presentation. To address these challenges, the paper presents augmented reality (AR) smart glasses as a possible solution. Interactive AR has huge potential for the DHH community because it provides a digital version of the real world, improving the usability of subtitled viewing or interpretation. The study examines previous research on the use of smart glasses in classrooms for DHH students and a custom AR prototype that shows promise in improving accessibility. The experience report deals with the evaluation of Vuzix Blade smart glasses equipped with Access on Demand (AoD) software conducted by the university. The assessment takes place in a variety of real-life scenarios, including attending a stand-up comedy show or attending a wedding speech where access services are not normally provided. The results of two DHH researchers using the Vuzix Blade with AoD highlight the potential of on-demand multimodal accessibility tools to address the needs of diverse users. The platform, which offers options to choose access services based on the user's preferences (interpretation or subtitles), proves its effectiveness in providing reliable and personalized accommodations to the DHH community.

III. LITERATURE SURVEY

[1]. This study aims to analyze the usability of a Google Glass application, with a particular focus on the app's efficacy as a visual aid for those who are blind or visually impaired (BVIP). Based on user feedback, Likert Scale Analysis is used in the study to assess usability hypotheses about the program, including how long users should spend getting used to the audio-based interface, how accurate the scene descriptions are, and how little time users should need for training. The application's limitations are also covered in the study, including how dependent it is on a reliable internet connection, how expensive it is, and how long its battery lasts.

[2]. As part of a rapid review procedure that takes less time than a typical systematic review, the aim of this work is to identify the characteristics of smart glasses and synthesize the evidence that is currently described in peer-reviewed publications.The lack of control over privacy, which was somewhat anticipated in the original concept of ubiquitous computing, is mentioned in the study as a drawback of smart glasses. Similar to the privacy concerns revealed by Google Glass, researchers had not yet developed strong solutions to these consequences. In order to better understand how users engage with technology and the outside world, the study makes the case for a multidisciplinary strategy that takes ethical and social implications into account in the early stages of research.

[3] The aim of this study is to investigate and evaluate research trends related to smart glasses, with a particular emphasis on their applications across multiple domains and the sensors and data processing techniques employed. The drawbacks listed include the possibility of privacy breaches from cameras and GPS sensors, the difficulty of designing a universal smart glass due to additional functionality, the requirement for user-environment-appropriate interaction technology, and the ongoing development of technologies to modify mobile app content for augmented reality use in smart glasses.

[4]. With the use of a small Raspberrypi-based device, the work described in this paper aims to improve communication for those who suffer from visual, auditory, or vocal impairments. This will enable them to interact with both regular people and one another. The primary drawback noted is the system's intricacy, which may be minimized by utilizing more straightforward coding languages for improved interoperability with other cutting-edge gadgets.

[5]. The device that can read text and turn it into audio, recognize currencies using a database, and detect obstacles using a PIR sensor is intended to help visually impaired people with their daily routines. One drawback noted is that although the PIR sensor can notify the user of obstructions, it is unable to identify the nature of the object, so restricting the amount of information accessible to the visually impaired user.

[6]. The purpose of the presentation is to discuss the development of the smart glass system, which is designed to provide real-time speech recognition and transcription to aid communication, language learning and independence for the hearing impaired. The future development of smart glass technology is also being explored. Disadvantages include challenges of accurate speech recognition, microphone design, display technology, power and battery life, comfort and ergonomics, and cost and availability.

[7]. The aim of the work is to find out the specific advantages of interfaces and their characteristics on cognitive and motor performance in virtual rehabilitation of stroke survivors. The aim of the research is to provide insights into the design and implementation of future virtual reality and rehabilitation systems that consider both cognitive and motor domains. The downside mentioned in the article is that better results when using traditional interfaces come at the cost of poor engine performance. In addition, the use of a 3D interface can cause patients to tire more quickly, resulting in shorter sessions

[8]. The aim of the work is to propose smart glasses designed to help hearing-impaired people become aware of important sounds, improve their ability to determine the direction of sounds and facilitate communication. This device uses active noise cancellation and speech recognition to help users in their daily lives, potentially improving safety and communication with others. The document does not specifically mention any disadvantages, but general potential disadvantages of such technology may include production costs, the need for user training, and limitations in effectiveness in certain environments or scenarios. Since specific disadvantages are not described in this context, I cannot provide page references for them.

[9]. The aim of the work is to present a special intelligent solution developed to help the hearing impaired by capturing environmental sound and converting it into text using neural networks to provide users with the necessary information in text format. . The disadvantages include the dependence on the speed of the transcriber, the need for a person with normal hearing to transcribe, and the outdated and energy-intensive technology of Google Glass, which also has an inefficient microphone and transmits more data than necessary.

[10]. The aim of the work is to develop a system that helps people with visual, hearing and sound disabilities using Raspberry Pi to correct their disabilities and provide solutions for the blind, deaf and mute. The system aims to facilitate communication between disabled and normal people using various functions such as picture to voice, text to voice and voice to text. Regarding the disadvantages, the document does not specifically mention the disadvantages of the proposed system. However, potential limitations may include technical challenges in implementing the system, hardware and software costs, and potential limitations in the accuracy and effectiveness of assistive functions.

[11]. The aim of the work is to propose an approach to the design of communication systems for the deaf and hard of hearing (DHH), combining technology and communication sciences. It aims to improve the inclusive communication of people with DHH and improve their integration into the hearing community. The article presents an empirical study that paves the way for other researchers. Disadvantages of paper The work does not present the results of the completed project, but presents a conceptual study. It also acknowledges the challenges and limitations of the technology, such as a lack of affordable options and technical issues. In addition, it highlights the need for further research and development in the field.

[12]. The purpose of this work is to present the Access on Demand (AoD) platform, an AR-based accessibility application designed to provide real-time captioning and sign language interpretation services to the Deaf and Hard of Hearing (DHH) community. The platform uses Vuzix Blade AR smart glasses and aims to improve the communication skills of DHHs in group chats and various real-world scenarios. Regarding shortcomings, the document discusses several limitations and areas for improvement of the AoD platform. These include issues with the Vuzix Blade AR smartwatch, such as shape, battery life, and Wi-Fi connectivity. In addition, the paper highlights the challenges of real-time interpreting and subtitling, as well as the need for hardware and software improvements to make the platform more reliable and efficient for DHH users.

[13]. The purpose of this paper is to evaluate the performance of current Automatic Speech Recognition (ASR) with voices of Deaf and Hard of Hearing (DHH) speakers. It aims to assess the usability of ASR technology for people with DHH and to analyze the significance of improvements in the use of DHH speech with ASR. Disadvantages of paper The paper does not clearly show any shortcomings. However, it highlights the variability of DHH speech and the usability challenges of ASR technology. Nor does it address the potential limitations of the research methodology or the broader implications of the findings.

[14]. The aim of the work is to investigate the use of smart glass technology to solve the problems of the hearing impaired, focusing in particular on speech recognition, siren recognition and name recognition. The research aims to combine the functions of smart glasses with machine learning technology to achieve these goals. As for the disadvantages, the paper does not clearly state the disadvantages. However, it is mentioned that the implementation of the functions of smart glasses requires a lot of preliminary work, which indicates possible challenges in the implementation process. In addition, the article discusses the amount of GSM/WIFI data required to run the application, which indicates a possible limitation of data usage.

[15]. Purpose: The purpose of the work is to propose a solution that uses smart glasses, IoT and machine learning techniques to help people with disabilities who are blind, deaf or mute. The goal is to provide technical assistance to improve vision, hearing and communication to improve the lives of disabled people. Advantage: The advantage of this document is that it can greatly improve the lives of people with disabilities through advanced technology. The proposed solution can provide assistance in object recognition for the blind, speech-to-text for the deaf, and text-to-speech for the deaf. If successful, this technology could have a positive impact on the social world and solve common problems that disabled people face in everyday life.

IV. METHODOLOGY

The methodology involves integrating essential components like a microcontroller, OLED display, microphone, camera, and power supply into a portable structure. The microphone captures audio, while voice recognition software converts speech to text. The resulting text is displayed on the OLED screen, projected in front of the user's eye for clear visibility.It Differentiates voice recognising the speaker.

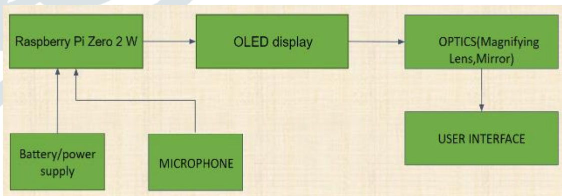
This approach ensures real-time transcription and accessibility, enhancing communication for individuals with hearing impairment in various scenarios, from educational settings to professional environments and everyday interactions. It empowers them with seamless engagement and participation, fostering inclusivity and independence in their daily lives.

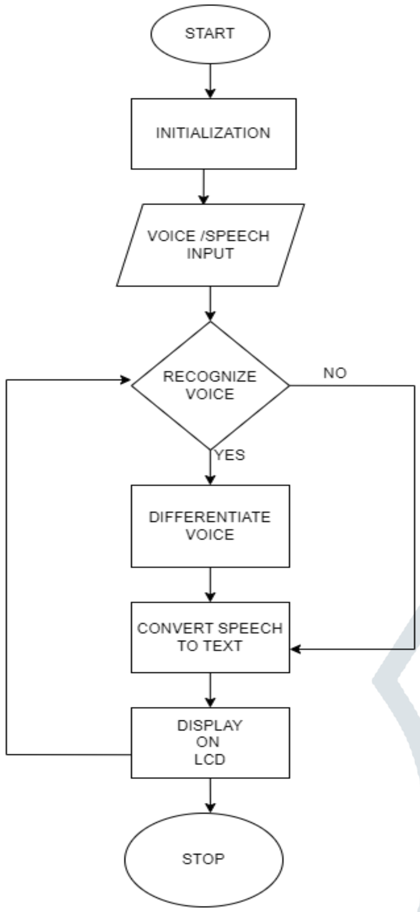
BLOCK DIAGRAM.

The block diagram depicts the device's core components and their connections. A Raspberry Pi Zero 2 W serves as the central processing unit, linked to a battery/power supply, OLED display, microphone, optics (magnifying lens, mirror), and user interface. This configuration highlights the device's structural layout and the integration of essential elements to facilitate real-time speech-to-text conversion and user interaction for individuals with hearing impairment.

FLOW CHART.

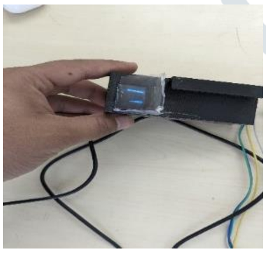
The flowchart outlines the sequential steps of the device's operation. It begins with initialization, followed by capturing voice/speech input. The system then proceeds to recognize and differentiate voices, converting speech to text. Finally, the text is displayed on an LCD screen before the process stops. This systematic approach ensures efficient real-time speech-to-text conversion for individuals with hearing impairment, enhancing communication accessibility and usability.





1. Connections Setup

- **Voice Differentiation Among Speakers**: It Differentiates between recognizing the speaker and giving the user an easy usage for the user.
- **Education Accessibility:** The device can be utilized



in educational settings to provide real-time transcription of lectures and discussions for students with hearing impairments, ensuring they have equal access to learning materials and class participation.
- **Professional Communication:** Individuals with hearing impairments can use the device in professional environments, such as meetings or conferences, to facilitate effective communication by accurately transcribing spoken content and identifying speakers.
- **Public Interaction:** It can be employed during public interactions, like customer service interactions or public announcements, to provide hearing-impaired individuals with instant access to spoken information, enhancing their engagement and inclusivity in society.
- **Personal Assistance:** Beyond public settings, the device can serve as a personal assistant for daily activities, helping users with hearing impairments communicate effectively with others, access audio content, and navigate their surroundings with ease.

VI. RESULTS.

2.Connections in Raspberry PI

3. Input From Microphone

VII. DRAWBACKS.

- **Limited Voice Recognition Accuracy:** The device may struggle with accurately recognizing and differentiating voices in noisy environments, leading

to potential errors in transcription.
- **Dependence on Display Quality:** The effectiveness of the device ... clarity and readability ... could be compromised ... conditions or due to hardware limi...

4. Module

5. Display on OLED

- **Complexity of Optics Integration:** Integrating optics components like magnifying lens and mirror may add complexity to the device's design and increase the risk of mechanical failures or calibration issues.

- **Potential Power Consumption:** Continuous operation of the device, especially during voice recognition and display processes, may consume significant power, leading to reduced battery life and the need for frequent recharging.

VIII. CONCLUTIONS.

- The project tackles key challenges facing individuals with hearing impairment, such as subpar display quality and limited modularity. By employing a methodical approach and integrating essential components like Raspberry Pi 3, OLED display, and microphone, it delivers real-time speech-to-text conversion and voice identification. The design emphasizes portability and ease of use, addressing the need for flexibility in assistive devices. Moving forward, continued refinement and innovation hold promise for further improving accuracy, reducing device size, integrating advanced AI algorithms, extending battery life, and broadening language support. Ultimately, this project represents a significant step towards enhancing accessibility and inclusivity for individuals with hearing impairments, promising a brighter and more inclusive future for assistive technology.

IX. FUTURE SCOPE.

- **Accuracy Enhancement:** Explore advanced algorithms to improve transcription accuracy, ensuring more precise and reliable speech-to-text conversion.
- **Miniaturization:** Work on shrinking device size for increased portability and convenience without compromising functionality or performance.
- **AI Integration:** Integrate artificial intelligence for enhanced voice recognition and context understanding, enabling more natural and intuitive interactions.
- **Battery Life Improvement:** Develop energy-efficient solutions to extend battery life, ensuring prolonged usage and uninterrupted assistance for users.

X. REFERENCES.

[1].Roya Norouzi Kandalan,Kamesh Namuduri ,"A Comprehensive Survey of Navigation Systems", June 2019

[2].Niek Zuidhof[1,3] ,Somaya 17 Ben Allouch[2] , Oscar Peters[1] , Peter-Paul Verbeek, "Smart Glasses: A Rapid Review of State-of-the-Art Perspectives and Future Challenges ",31 October 2021

[3].Dawon Kim and Yosoon Choi ,"Applications of Smart Glasses in Applied Sciences",27 May 2021

[4].Charlotte Romare ,Ursula Hass ,Lisa Skär,"Healthcare professionals' views of smart glasses in intensive care",28 November 2017

[5]. D. B. K. Kamesh, S. Nazma, J. K. R. Sastry , S. Venkateswarlu, "Camera based Text to Speech Conversion,Obstacle and Currency Detection" ,August 2016

[6]. Noel Jacob, Rajat Mathew, Sathwik P Nair, Prof. Divya Sunny, "smart glasses with real-time speech recognition and transcription for the hearing impaired",01 July 2023

[7]. 2019K. Tada, K. Kutsuzawa, D. Owaki and M. Hayashibe, Quantifying Motor and Cognitive Function of the Upper Limb Using Mixed Reality Smartglasses, 2022 44th Annual International Conference of the IEEE Engineering in Medicine Biology Society (EMBC), 2022.

[8]. Md. Latifur Rahman and S. A. Fattah, "Smart Glass for Awareness of Important Sound to People with Hearing Disability", 2020 IEEE Region 10 symposium

[9]. Ales Berger, "Prototype of a smart google glass solution for deaf (and hearing impaired) people ",July 2018

[10]. Suvarna Nandyal, Shireen Kausar," Raspberrypi Based Assistive Communication System for Deaf, Dumb and Blind Person", ISSN: 2278-3075 (Online), Volume-8 Issue-10, August 2019.

[11]. Susanna Berra, Cláudia Pernencar, Flávio Almeida,"Silent augmented narratives inclusive communication with Augmented Reality for deaf and hard of hearing." July 2020.

[12]. Roshan Mathew, Brian Mak, Wendy Dannels, "Access on Demand: Real-time, Multi-modal Accessibility for the Deaf and Hard-of-Hearing based on Augmented Reality", Oct 2022 .