

App Based Digital Audiometer

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Abstract: Hearing impairment is a widespread health concern on a global scale that affects individuals across all age groups. The timely identification and regular monitoring of one's hearing ability are crucial factors for prompt intervention and an improved overall quality of life. However, the traditional method of audiometry comes with limitations such as the need for specialized equipment and professional supervision making it inaccessible and expensive for many individuals seeking hearing assessments. To address this issue a cutting-edge approach has been developed in the form of a Digital Audiometer App offering a convenient cost-efficient and user-friendly means of assessing one's auditory function. This innovative tool utilizes the widespread use of smartphones and wearable devices allowing for a portable and accessible method of hearing assessment. The system integrates advanced signal processing techniques intuitive interfaces and reliable calibration processes to guarantee precise and consistent results. Additionally, the audiometer is compatible with both iOS and Android platforms ensuring its availability to users worldwide

Keywords: Hearing impairment, Audiometry, Timely identification, Regular monitoring, Digital Audiometer App, Cost-efficient, User-friendly

I. INTRODUCTION

According to the World Health Organization (WHO) approximately 360 million individuals are affected by hearing loss worldwide. This widespread issue has become a significant concern in the healthcare industry. Sadly, it is observed that most of these cases occur in low- and middle-income countries [1]. The consequences of hearing loss on an individual's life are multiple and severe. It fundamentally impedes their ability to communicate with others leading to feelings of depression isolation insecurity and frustration [2 3]. In addition, it affects their social and emotional well-being academic performance and economic stability. Therefore, early detection of hearing loss is crucial. Audiological services play a pivotal role in this regard but unfortunately, they are not easily accessible due to the shortage of trained professionals and limited resources [4]. As a result, there is a substantial gap between the demand for these services and their availability. In recent years mobile devices have advanced significantly and evolved into miniature computers that fit in our pockets. With advanced wireless networks like 3G and 4G cellphones make it effortless to access the internet. Furthermore, the use of health-related apps has gained popularity [5]. Such apps are time-efficient and enhance productivity by accelerating diagnoses and minimizing unnecessary visits to medical facilities. Some apps are developed for healthcare professionals while others are specifically designed for patients recommended by their doctors. An array of smartphone-based hearing apps is already in existence. These innovative programs function similarly to automated audiology conveniently accessible on our smartphones. They are free of cost and offer self-testing options anytime anywhere. Moreover, they do not require any technical expertise and can be completed in a matter of 5 minutes.

II. PROBLEM STATEMENTS AND DEFINITIONS

Hearing Health Awareness:

- Lack of awareness: Many individuals are unaware of the importance of regular hearing assessments and the potential consequences of untreated hearing issues.
- Stigma: Stigmatization of hearing loss can discourage individuals from seeking help or using traditional audiometers.

Accessibility and Availability:

- Limited access to audiologists: In many regions, there is a shortage of trained audiologists and hearing healthcare facilities.
- Geographical barriers: People living in remote or underserved areas may have limited access to hearing assessment services.

Cost of Testing:

- Traditional audiometry tests can be expensive, making them inaccessible to individuals with limited financial resources.

Inconvenience:

- Scheduling appointments: Booking appointments with audiologists can be time-consuming and inconvenient.
- Travel: Patients may need to travel long distances to access hearing healthcare services.

Early Detection:

- Delayed detection: Hearing issues often go undetected until they have progressed significantly, leading to a greater impact on the individual's quality of life.

Monitoring Hearing Health:

- Lack of tools: There is a lack of accessible tools for individuals to monitor their hearing health over time.
- Difficulty in tracking changes: It can be challenging for individuals to track changes in their hearing thresholds without regular assessments

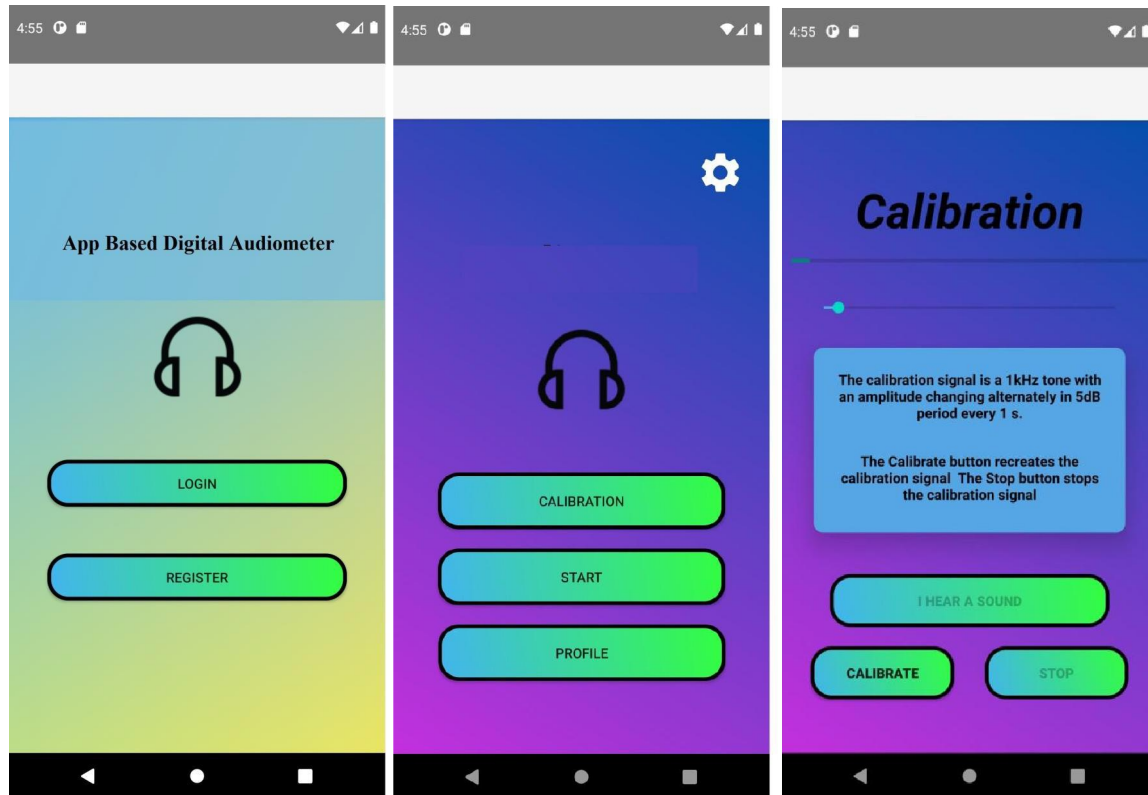
III. METHODOLOGY

The development of a mobile application for the hearing loss screening using air conduction audiometry was carried out in accordance with the standards of the software engineering. An Android based audiogram profiling app that highlights the hearing loss in people. An audiogram is a graph that shows what the softest sound a test person can hear is. The test is carried out on sounds of different frequencies (i.e. pitches), the hearing threshold for different sounds can be determined. The values in dB HL are placed on the vertical axis, the less dB will be obtained in the test, the lower the hearing loss will be. The standard in the tests is lower than 25 dB HL inclusive. The frequencies are plotted on the horizontal axis. The value of the sensitivity of our hearing is therefore at the intersection of these two values. The application is fully functional and requires additional configuration to run locally. It requires connection to Firebase.

IV. RESULTS AND DISCUSSION

The Digital Audiometer App represents a significant advancement in addressing the global concern of hearing impairment. By leveraging the ubiquity of smartphones and wearable devices, this innovative tool offers a convenient, cost-efficient, and user-friendly means assessing auditory function. Unlike traditional audiometry methods which require specialized equipment and professional supervision, the app provides accessibility to individuals across all age groups, regardless of geographical location or financial constraints.

Key features of the Digital Audiometer App include advanced signal processing techniques, intuitive interfaces, and reliable calibration processes, ensuring precise and consistent results. Its compatibility with both iOS and Android platforms further enhances its accessibility, making it available to users worldwide. By enabling timely identification and regular monitoring of hearing ability, the app facilitates prompt intervention and improves overall quality of life for individuals with hearing impairment. This groundbreaking approach has the potential to revolutionize hearing assessments, making them more accessible and inclusive on a global scale.



V. CONCLUSION

The development of the 'App-based Digital Audiometer' for hearing loss screening using air conduction audiometry marks a significant stride in enhancing accessibility to preliminary hearing tests. The project adhered to established software engineering processes, ensuring a systematic approach to meet specific objectives and requirements. The primary objective of the application was to provide users with a convenient and user-friendly tool for assessing their hearing health at home. The 'App-based Digital Audiometer' achieves this goal through the implementation of pure-tone air conduction audiometry, following procedures closely aligned with the ISO 8253-1:2010 standard. The calibration and settings functionalities play a pivotal role in ensuring the accuracy of test results. The decision to apply a biological calibration method, considering the diversity of mobile devices and headphones in the market, demonstrates a pragmatic approach to address challenges associated with traditional calibration methods.

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