DESIGN INTELLIGENCE
BEMM486

EXECUTIVE SUMMARY REPORT

(GROUP 11)

DESIGN DEVELOPMENT FOR INDEPENDENT LIVING OF DEAF PEOPLE

Team Members:
Bhadra Anilkumar – 730064831
Shashank R - 730074631
Shivani Sankannavar - 730086009
Sumukh Nagesh Bharadwaj- 730064965
Vaibhavi Ramesh - 730074762

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Introduction:

According to the World Health Organization, over 5% of the world's population – approximately 466 million people – experience disabling hearing loss. This impairment significantly affects individuals' ability to communicate, navigate their environments safely, and participate fully in various aspects of daily life. As such, there is a growing need for innovative assistive technologies that address the unique challenges faced by individuals with hearing impairments.

This report explores the development and potential benefits of a portable noise detection system designed specifically for individuals with hearing impairments. By leveraging user understanding and research data, this system aims to enhance accessibility and safety for users in diverse environments and situations.

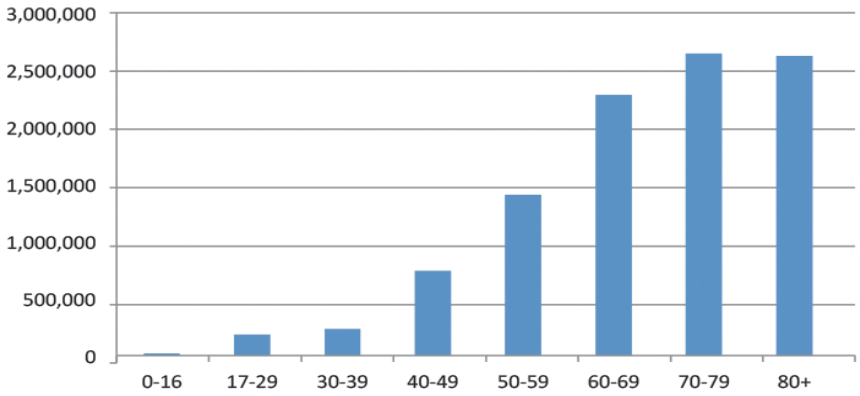
Background:

The prevalence of hearing impairments underscores the critical importance of developing assistive technologies to enhance the quality of life for affected individuals. Research plays a pivotal role in crafting innovative solutions, particularly when addressing the complex challenges encountered by specific communities. In pursuit of qualitative and quantitative insights, a thorough review of research papers and datasets was undertaken. Two primary sources significantly contributed to shaping our understanding of the difficulties faced by the deaf community:

1. "*Deaf people in a hearing world: A qualitative study of cultural identity issues*" shed light on the profound communication hurdles and the pervasive sense of isolation experienced by deaf individuals, even in densely populated settings.
2. "*The needs of older people with acquired hearing and sight loss: findings from 20 case studies*" provided invaluable secondary data derived from the real-life experiences of 20 individuals grappling with daily challenges associated with hearing impairment.

This research underscored prevalent pain points, including communication barriers, transportation limitations, technology accessibility issues, dependency on others, restricted access to emergency services, and a general unawareness of surrounding events.

The below graph illustrates the distribution of the deaf population across various age groups in the UK.



These challenges, ranging from communication barriers to technological accessibility issues, laid the groundwork for the development of three distinct user personas:

1. **Sarah**, a 28-year-old professional working in the IoT industry, faces communication difficulties in her workplace due to her hearing impairment.
2. **Thompson**, an 80-year-old man living independently, experiences challenges in daily activities such as missing auditory cues like running taps and doorbells, impacting his safety and well-being.
3. **Emily**, a mother with hearing impairment, navigates the dual concerns of disability and maternal responsibilities, with a constant fear of missing out on crucial auditory cues concerning her child's well-being.

While existing solutions such as hearing aids and cochlear implants primarily focus on amplifying sounds or restoring auditory function, they may not adequately address the safety and accessibility needs of individuals with hearing impairments. These insights underscore the necessity for concepts that not only focus on sound amplification but also utilize appropriate messaging to alert users to pertinent information about their surroundings.

Design Concepts

Following our comprehensive research, we have formulated three distinct design concepts.

Wearable Sign Language Translation Device:

- A wearable device translating sign language into text or speech in real-time.
- Enhances communication between deaf and non-signing individuals.

Personal Robot:

- A companion robot assisting deaf individuals in daily tasks.
- Features include speech-to-text conversion, environmental sound detection, and emergency response capabilities.

Portable Sound/Noise Detection System:

- A portable device detecting important auditory cues and providing visual or tactile alerts.
- Enhances safety and awareness for deaf individuals in various environments.

SWOT Analysis of Three Design Concepts:

SWOT Analysis	Wearable Sign Language Transalation Device	Personal Robot	Portable Sound/Noise Detection System
Strengths	Facilites communication for sign langauge users like Emily, Sarah and Thompson	Provides sense of security and companionship	Enchances safety and awareness for individuals with hearing impairments
	Enchances inclusivity in sign language prevalant environments,benefiting Sarah and Emily	Gives assisstance with tasks	Provides real time alerts for important sounds,enabling prompt response
	Offers an alternative communication method for individuals with hearing impairments		Alleviates Emily's anxiety by detecting her child's cries
Weakness	Relying solely on sign lanaguage may not address her immediate need	May not address specific concerns of Emily related to	May require regular calibiration posing a challenge for users seeking simplicity
	May not Align with Mr Thompson's desire for independence	Perceived as a novelty rather than a practical solution to her specific challenges in case of Sarah	Limited functionality beyond sound detection and notification
	Could be perceived as cumbersome or impractical for Mr Thompson's limited social		
Opportunities	Integration with AI and natural language processing could enhance translation accruacy	With AI addition it could enhance adaptability to user's	Integration with devices could enhance utility
	Customization options could increase utility for diverse user groups	Development of specialized features could cater to	Development of customizabale alert settings could cater to specific user preferences
	Partnerships with eduactional instituitions could promote adoption	Collaboration with healthcare providers could facilitate	Collaboration with healthcare providers could facilitate adoption
Threats	Competition from emerging technologies	Consumers skepticism towards	Competition from similar assistive devices
	Limited market reach due to niche audience	Competition from established	Concerns regarding privacy and data security

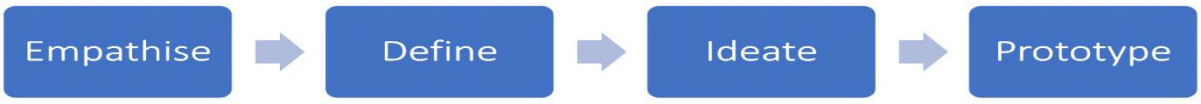
Design Process Flowchart:

This flowchart represents a basic outline of how a voice detection system functions, from capturing audio input to triggering alerts based on detected sounds.

Rationale for the selected concept:

The Portable Sound/Noise Detection System was selected due to its potential to address critical safety and accessibility needs for individuals with hearing impairments, as highlighted by user personas. Data insights from user personas and research on assistive technologies informed the design of the device, ensuring it meets the needs of most of its target users. Ethical considerations, including accuracy in sound detection and user privacy, are addressed through rigorous testing and transparent data handling practices.

Design Process



The design thinking process was chosen for its human-centred approach, essential in addressing the unique needs of deaf individuals. By empathizing with their experiences, defining specific challenges, ideating innovative solutions, and prototyping iteratively, we ensured our designs were informed by real user insights, leading to more inclusive and effective solutions tailored to the needs of the deaf community.

Concept Development:

The concept of a portable noise detection system emerged from an iterative process that integrated user feedback, research data, and design thinking principles. User personas, including Mr. Thompson, Sarah, and Emily, provided valuable insights into the specific needs

and preferences of individuals with hearing impairments across different demographic profiles and life stages.
The system's development involved collaboration between engineers, designers, and healthcare professionals to ensure that it effectively addressed users' safety and accessibility needs. Hardware components were carefully selected to optimize portability, durability, and performance, while software algorithms were developed to analyse sound patterns and determine the significance of detected sounds.

Below are images of **HEARO**, our innovative Portable Sound/Noise Detection System designed to provide visual alerts for various sounds, aiding deaf individuals in their daily activities.

Potential Benefits:

The portable noise detection system offers several potential benefits for individuals with hearing impairments:
Enhanced Safety: Real-time detection and alerting of important sounds, such as alarms, sirens, or verbal cues, reduce the risk of accidents and improve situational awareness.
Increased Independence: By providing timely alerts and information about their surroundings, users can navigate environments more confidently and independently, leading to greater autonomy and self-sufficiency.
Improved Quality of Life: Alleviation of anxiety related to missing critical auditory cues enhances users' overall well-being and enables more active participation in social, professional, and recreational activities.

Applications:

The portable noise detection system has a wide range of applications across various contexts:
Personal Use: Everyday activities such as cooking, gardening, or traveling become safer and more manageable with real-time alerts about important sounds in the environment.
Professional Use: In workplace settings, the system enables individuals to effectively communicate, collaborate, and respond to auditory cues, thereby enhancing productivity and job performance.
Parental Use: Parents of young children can benefit from the system's ability to detect and alert them to their child's cries or calls for help, providing peace of mind and ensuring timely responses to their needs.

Ethical Considerations:

The design of a smartwatch for the deaf, capable of detecting and alerting to various sounds through vibration or on-screen notifications, follows ethical principles by prioritizing accessibility and inclusion. It empowers individuals with hearing impairments by providing them with crucial auditory information in real-time, enhancing their safety and quality of life. Respect for user autonomy and privacy is ensured through customizable settings, allowing users to control their notifications and data sharing. This design ensures equity by addressing the needs of a marginalized community, exemplifying technology's potential to promote social good and ethical advancement.

Conclusion:

In conclusion, the development of a portable noise detection system represents a significant step towards addressing the safety and accessibility needs of individuals with hearing impairments. By integrating user understanding, research data, and design innovation, this system has the potential to enhance the quality of life for users by improving their safety, independence, and overall well-being.

Individual Contribution:

Bhadra Anilkumar: Went through different research data and academic papers to understand deaf individuals and their pain points and develop design concepts based on it. I also supported the team in developing presentation materials and documenting our progress.

Shashank R: Took initiative for creating visualizations, prototypes, and editing images to effectively communicate our design concepts.

Shivani Sankannavar: Took initiative to create a flow chart and designed the steps for the process of product development. Devised SWOT analysis to understand the best product that was suitable for all three personas. Learned the importance of prototyping and iteration in refining design concepts.

Sumukh Bharadwaj: Gathered data and statistics about the deaf population who belonged to different background and age groups. Suggested on what populations to focus on and how it could relate to our ideology.

Vaibhavi Ramesh: Based on the Gathered qualitative data and in-depth analysis of their pain points, created the personas/Users to represent various experiences within deaf community. Suggested on customised developments for each persona.

As a team, we got an opportunity to design a product for independent living where we chose to help the deaf of all age groups with different pain points. Each of us collectively came up with multiple design ideas for the same and concluded to proceed with THE HEARO- The Sound/Noise detection system, as it in accordance with all the user personas and our motive. The above report is a result of collective ideas of all the group members.

Reflections:

Bhadra Anilkumar: This project served as a valuable learning experience, allowing me to apply theoretical concepts in a practical setting and develop tangible solutions that address real user needs. Engaging in the assignment challenged me to think creatively and innovatively to address complex problems faced by individuals with hearing impairments.

Shashank R: Through this project, I understood the significance of addressing specific user needs, collaborating with team members, and leveraging research for impactful design solutions. Moreover, I've recognized the importance of iterative prototyping and ethical considerations in developing inclusive technology.

Shivani Sankannavar: This course highlighted the importance of designing products that is user centric. I've learned the value of prototyping in refining design concepts and solutions based on user input and challenges so we can better meet their needs and preferences.

Sumukh Bharadwaj: Learnt that there can be multiple design ideas for the same product. Working with a group has taught me that every individual has a different perspective about the same concept which can then be constructively used to design One that aligns with all ideas. Going further, I would try to integrate others' opinions as well to the original design idea to enhance the features for the betterment of the design.

Vaibhavi Ramesh: Creating personas helped me understand the challenges faced by the deaf community, which guided us in tailoring solutions to their needs. Working together as a team taught me the value of communication and making decisions together to ensure our ideas met the diverse needs of our users.

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