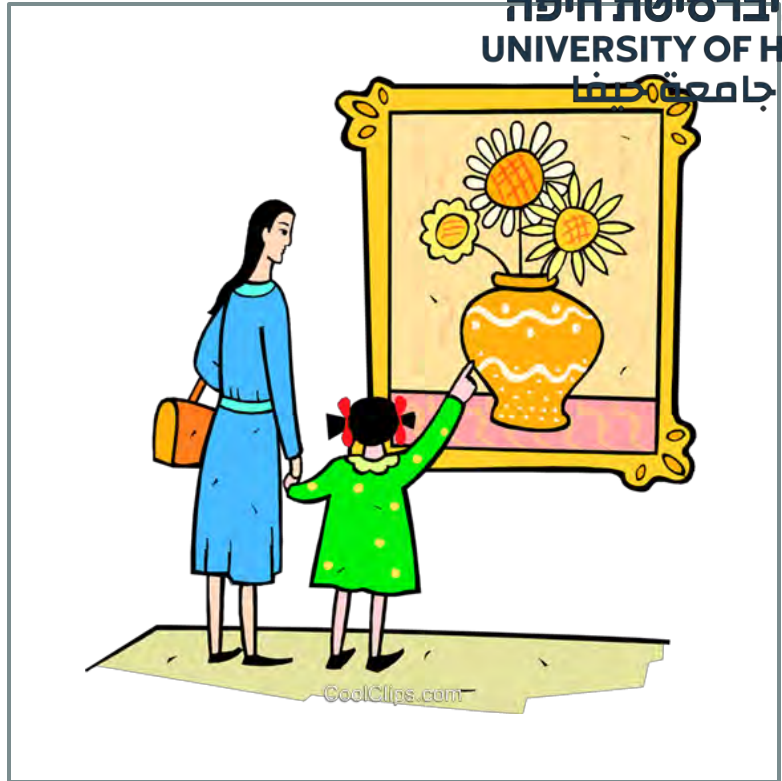


SMARTIE: SMART MUSEUM FOR ALL USING A RANGE OF TECHNOLOGIES FOR INCLUSIVE EXPERIENCE

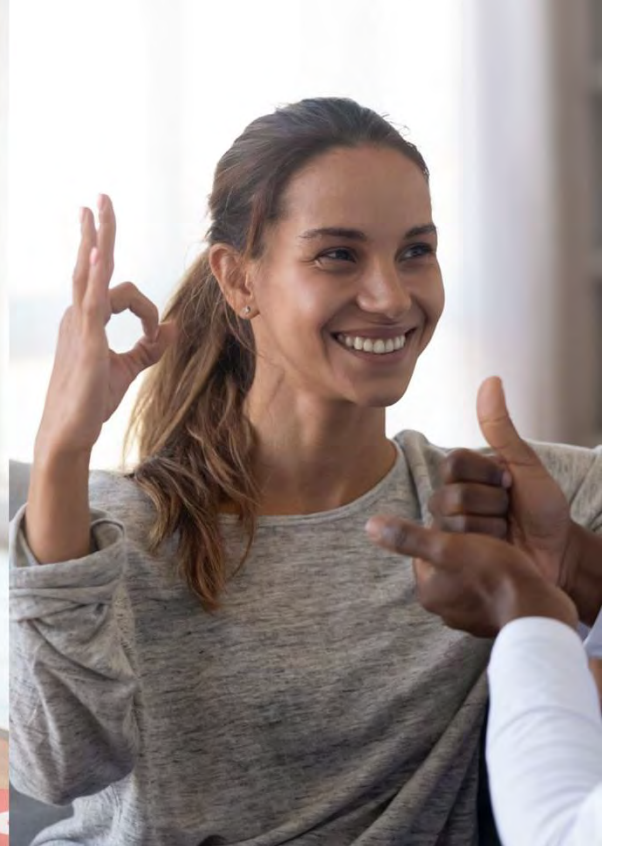
ALEXANDRA DANIAL-SAAD,¹ YAEL AVNI,¹ JULIA SHEIDIN^{1,2} AND TSVI KUFLIK¹

¹ THE UNIVERSITY OF HAIFA, ABBA KHOUSHY AVE 199, HAIFA, 3498838, ISRAEL

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MUSEUM AS CULTURAL AND LEARNING HUBS



ACCESSIBILITY GAINS IMPORTANCE AND IS BECOMING A CENTRAL COMPONENT ON THE AGENDA OF CULTURAL AND HERITAGE SITES

MOTIVATION: MUSEUMS ROLE AND SETUP

The traditional museum setup poses challenges for individuals with disabilities

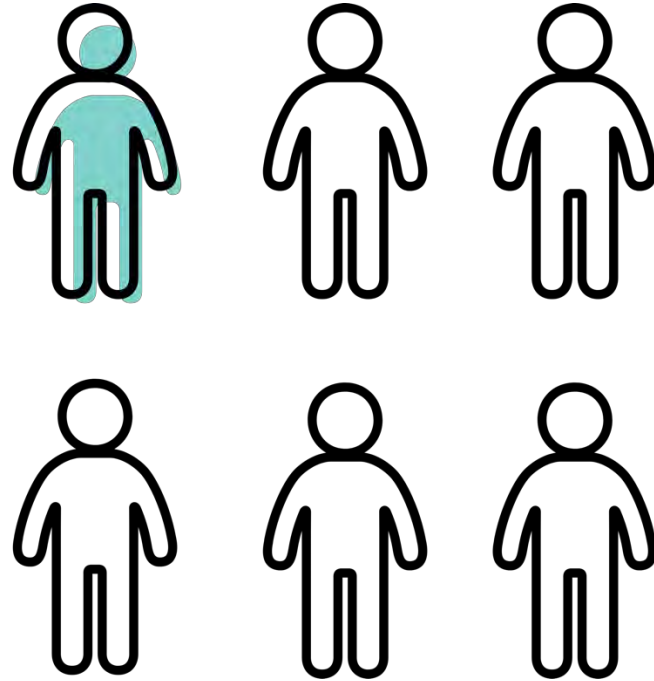
- Limited exploration opportunities
- Museum labels



DISABILITY: KEY FACTS



16%



7%

WELL-ADAPTED TECHNOLOGIES CAN

- Contribute to the visitors' varied needs
- Bring the user closer to previously inaccessible artifacts and sites
- Enable the visitors to function independently and with dignity
- Improve the quality of experience



A CASE STUDY: SUPPORTING BLV VISITORS IN MUSEUMS

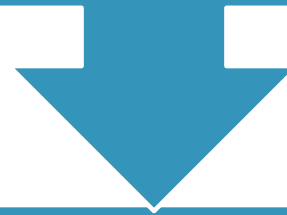
To enhance museum accessibility for visitors with visual impairments, specifically those who are blind or have low vision (BLV), a recent study developed and implemented four Interactive Tangible User Interfaces (ITUIs).



Avni Y., Danial-Saad A., Sheidin J. and Kuflik T., (2024) "Enhancing Museum Accessibility for Blind and Low Vision Visitors Through Interactive Tangible User Interfaces".
Submitted to International Journal of Human-Computer Studies.

METHOD: THE COURSE

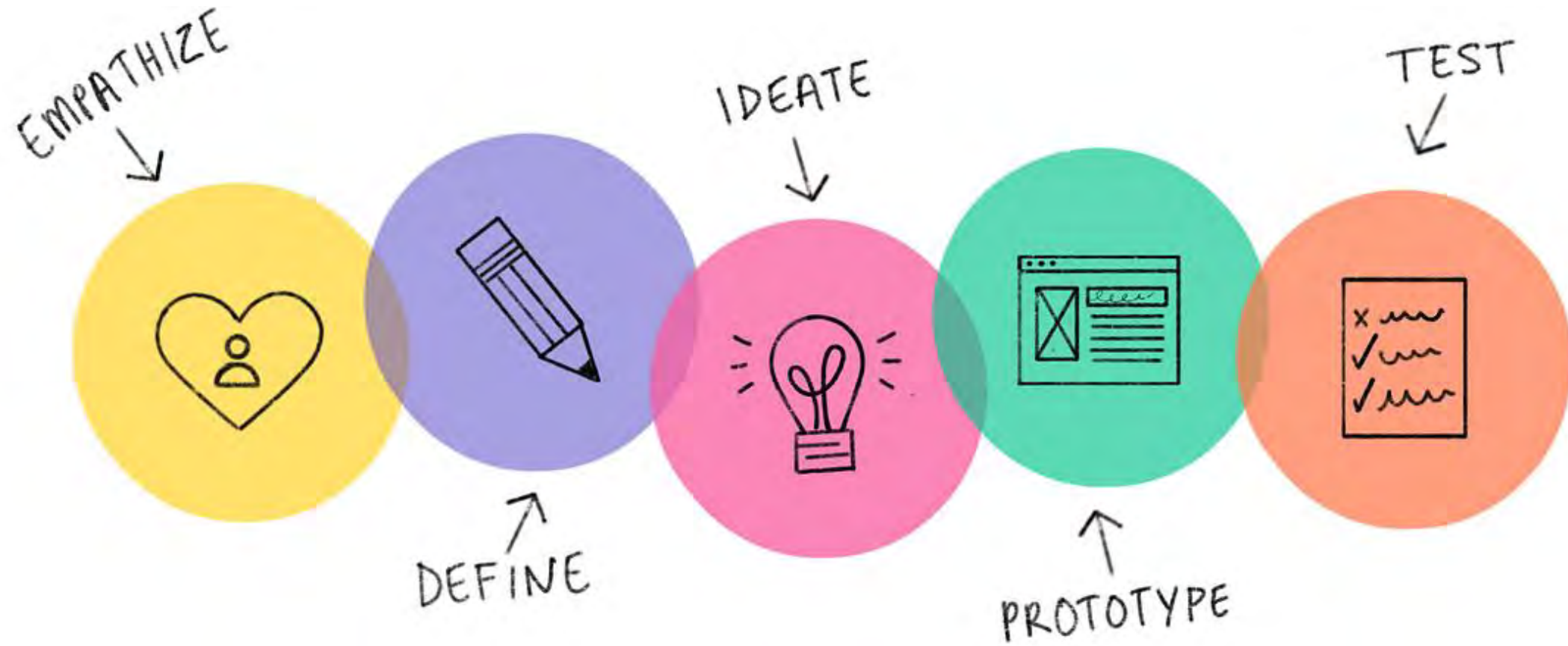
This initiative built on the achievements of our "Advanced Technologies in Development and Rehabilitation" course



The course combined theoretical and practical aspects, aimed at developing several experiential kits (for specific cultural heritage topics) for visually impaired visitors

IMPLEMENTATION PROCESS

The implementation process included all stages of Design Thinking:



IMPLEMENTATION: EMPATHIZE



Talking with the museum staff

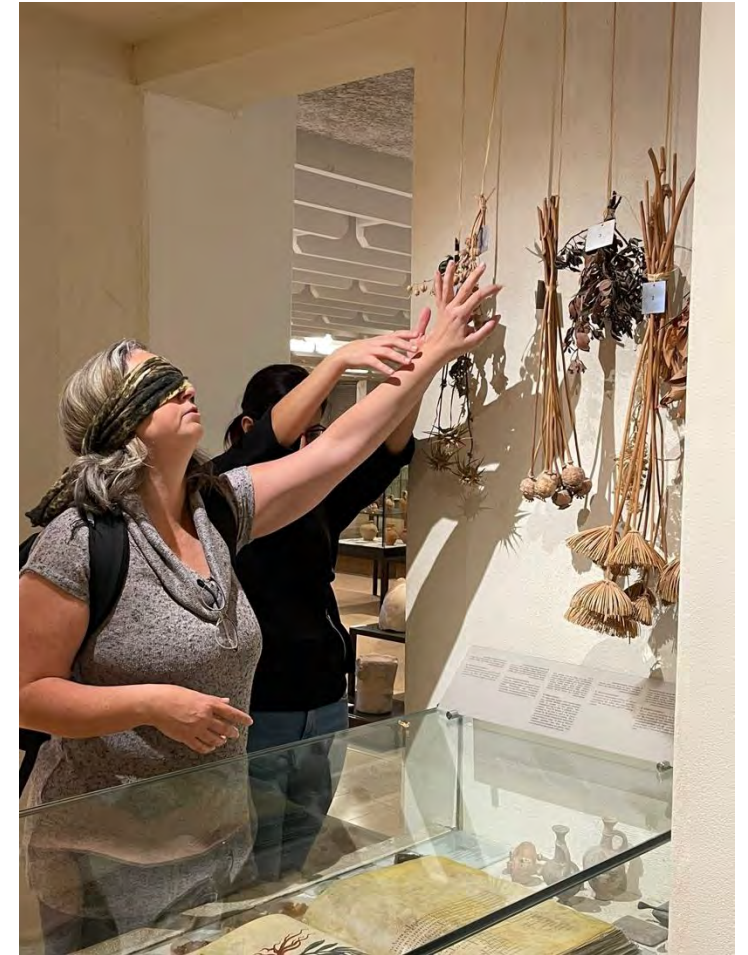
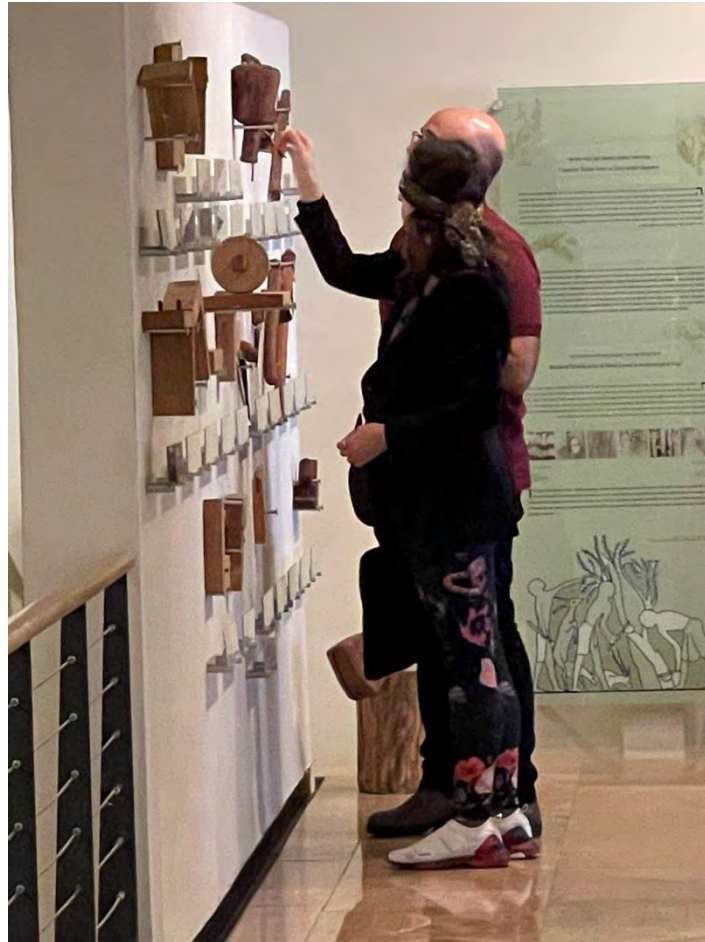


Accompanying individuals with visual impairments during the visit to the museum



Reviewing relevant literature

I. EMPATHY– EXPERIENCING THE CHALLENGES AND OBSERVING BLIND VOLUNTEERS – THE VISIT



MUSEUM VISIT – EXPERIENCING THE CHALLENGES AND OBSERVING BLIND VOLUNTEERS – ON THE WAY



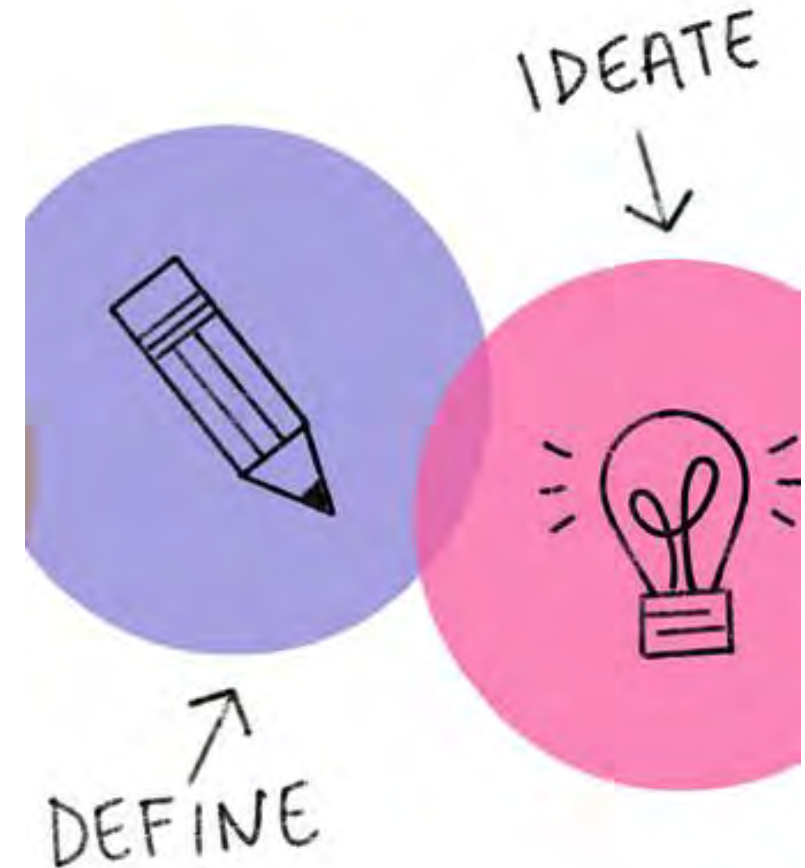
A SUCCESSFUL OUTCOME BEGINS WITH CHOOSING THE MOST APPROPRIATE AT FOR A PERSON. HOW CAN WE BEST DO THAT?



- Concept definition – based on literature review
- Re-thinking and re-shaping the concepts base on the museum visit with users

IMPLEMENTATION: DEFINE & IDEATE

- This includes creative thinking about the use of relevant state-of-the-art technologies:
 - 3D replicas of objects within multimodal interaction systems
 - Interface activation methods (input)
 - Audio playback methods (output)
 - The arrangement of the 3D-printed replicas on the ITUI's top surface



IMPLEMENTATION: PROTOTYPE & TEST



The teams were asked to produce semi-working prototypes that can be tested with actual users.



All groups faced the same questions regarding interaction design and each of them chose to solve them differently.



For the initial usability test, students employed the Wizard of Oz testing technique.

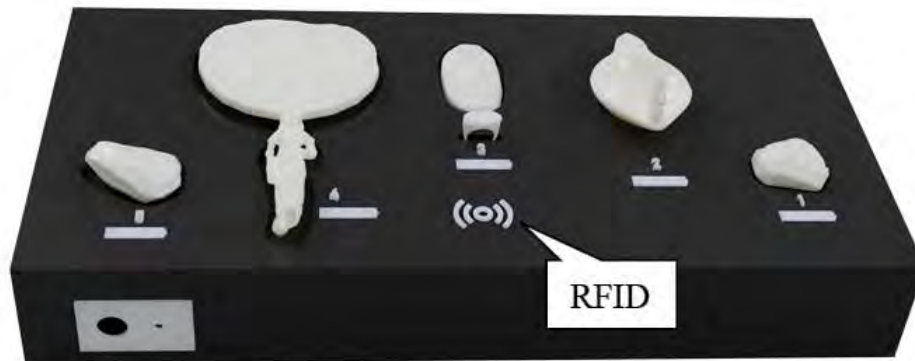
THE RESULT: SUPPORTING BLV VISITORS IN MUSEUMS



The Mythology & Autoplay ITUI operating system



The Writing & Pushbuttons ITUI operating system



The Burial & RFID scanning ITUI operating system



The Ancient Weapons & RFID scanning ITUI operating system

MOTIVATION: LIMITATION OF CURRENT APPROACHES

- May not fully capture the complex needs of users with disabilities
- Diversity makes it challenging to create a single solution that works equally well for all users
- Overlooking how a user's condition might change over time or how adaptive technologies might evolve



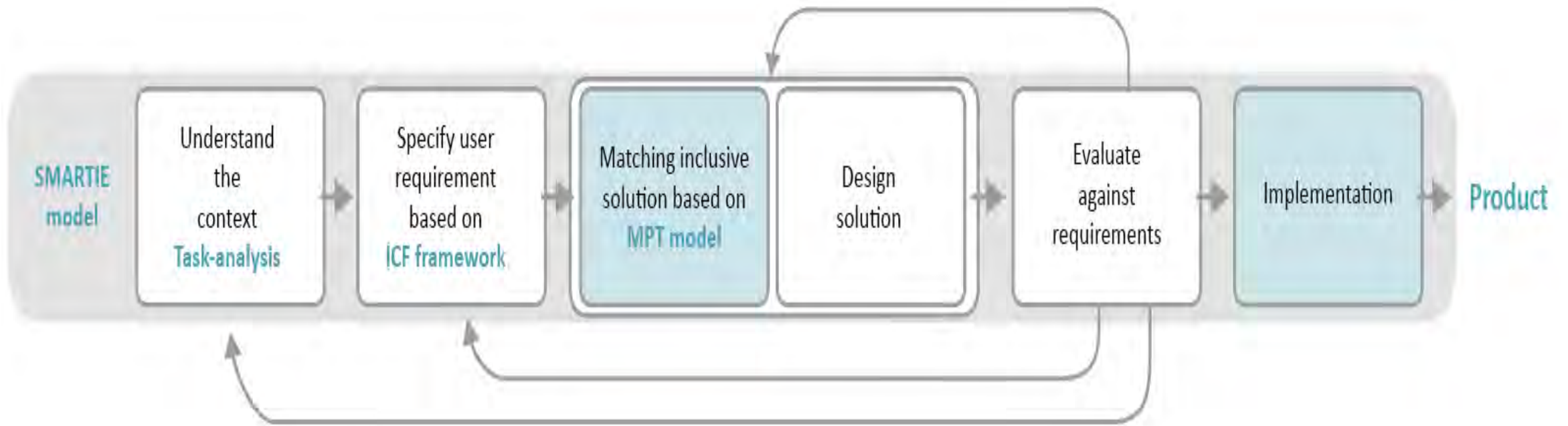
RESEARCH QUESTION

“How can we model a generic design process of solutions for enhancing the museum visit experience for people with disabilities using state-of-the-art technologies while minimizing the changes needed in existing museums?”



SMARTIE

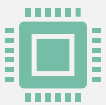
The novel SMARTIE model:



SMARTIE



The novelty of the proposed model lies in its integration of analytical methods from the fields of Information and Communication Technology, the Internet of Things, and 3D printing technologies with the key principles of inclusive disability participatory design.



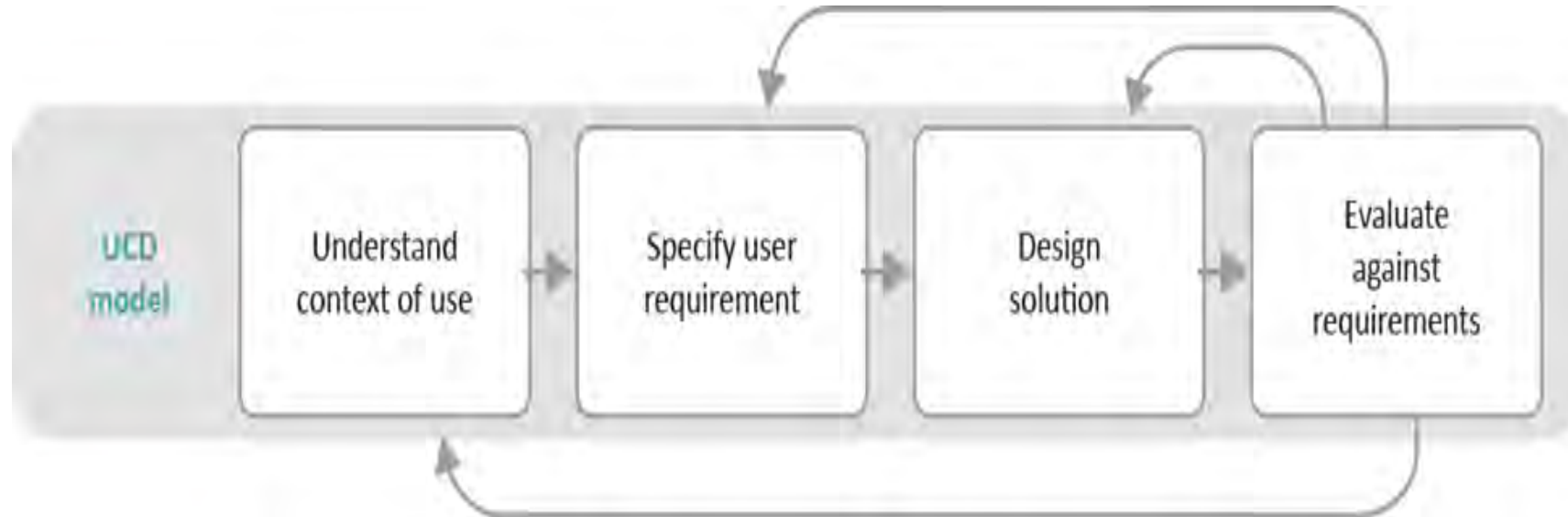
The proposed model integrates analytical methods from Information and Communication Technology, the Internet of Things, and 3D printing technologies with the principles of inclusive disability participatory design.



The goal is to identify a comprehensive model for evaluating technical developments before adoption, rather than focusing on specific technologies' effectiveness in technology-supported accessibility.

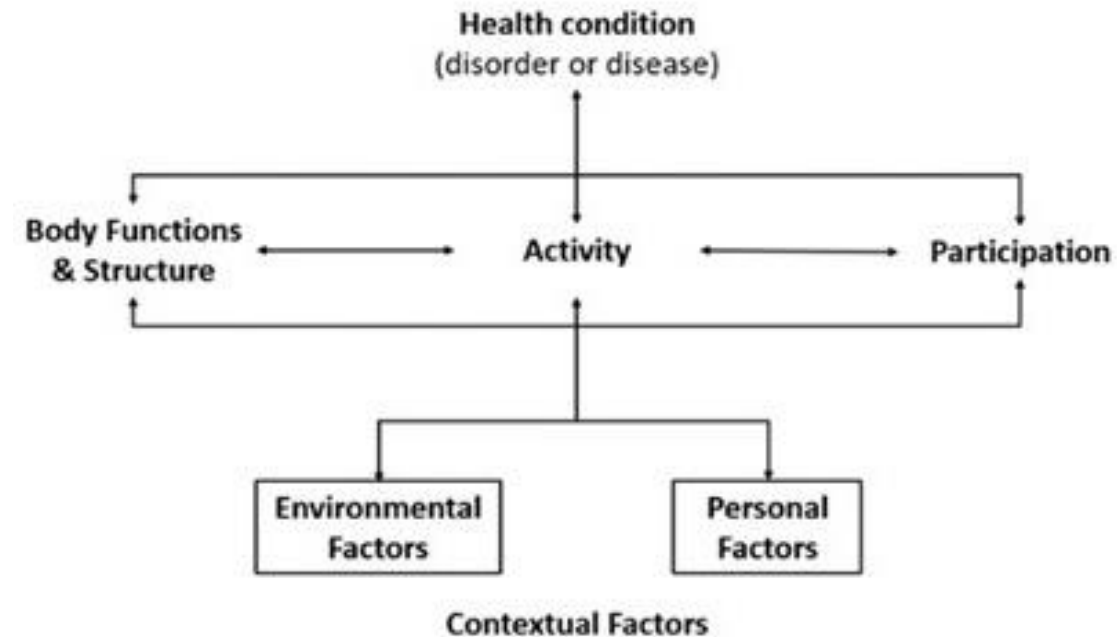
USER-CENTERED DESIGN (UCD)

Four distinct phases of the UCD:



INCORPORATING USERS WITH DISABILITIES INTO THE DESIGN PROCESS

- The ICF framework facilitates a more nuanced understanding of the "context of use" by analyzing user functioning and disability within the specific scenario of a museum visit.
- By integrating this multifaceted approach, SMARTIE enhances its capacity to anticipate and address latent user needs that may not be immediately discernible through direct user feedback alone.



International Classification of Functioning, Disability and Health – ICF. World Health Organization (September 2001).

MATCHING INCLUSIVE SOLUTIONS BASED ON MPT MODEL

The MPT model is predicated on two fundamental principles:

- A focus on triadic interaction: In museum accessibility, this interaction involves visitors with various disabilities, the assistive technologies used, and the museum environment.
- A holistic and collaborative approach: This process facilitates collaboration between professionals (e.g., museum staff, accessibility experts, designers) and users (disabled visitors) to understand the user's needs within their respective environments.



Scherer & Craddock, 2002

SMARTIE: DEFINITION



SMARTIE's strength lies in its synergistic integration of UCD, ICF, and MPT.



By combining them, SMARTIE addresses not just the technical aspects of accessibility but also the personal, social, and environmental factors that affect a visitor's museum experience.



This integrated approach allows for more nuanced, personalized, and effective accessibility solutions in museum settings.

SMARTIE: DESIGN SOLUTIONS

Integrating

Integrating the comprehensive disability understanding.

Applying

Applying the integrated concepts to the museum context, addressing the unique challenges and opportunities.

Providing

Providing a more granular framework that allows users to map their needs to technological solutions within the museum environment.

Emphasizing

Emphasizing the dynamic interaction between visitors, technologies, and the museum space.

SMARTIE: DEVELOPMENT



Gather relevant data from multiple sources to define the model: a systematic review using a meta-analysis to map technology-supported accessible museums in the health and information systems domains



Develop the model architecture and components using a multidisciplinary approach



Implement the model by constructing and designing technology solutions for real-life test cases of users

SMARTIE: EVALUATION AND REFINEMENT



Usability, satisfaction, and implementation testing to assess the inclusive experiences in smart museums



The use of the person-environment fit model to assess environmental implementation

SMARTIE: APPLICATION IN MUSEUM ACCESSIBILITY

Visual Impairments: we will examine how the SMARTIE model allows us to improve the ITUIs we developed to enhance museum experiences for visually impaired visitors.

Mobility Impairments: the SMARTIE model proposes comprehensive adjustments beyond basic accessibility measures. For instance, it recommends more extensive adaptations than simply aligning the height of paintings with visitors' eye level.

Cognitive Impairments: the SMARTIE model informs the development of multi-faceted accessibility solutions for visitors with cognitive impairments.

CONCLUSIONS AND FUTURE WORK

- An innovative, multidisciplinary approach.
- Synthesizing design principles from human-computer interaction with accessibility guidelines.
- Engineered to guide the development of novel assistive technologies to enhance museum experiences for visitors with disabilities.
- Ensures that the resulting assistive technologies are technologically advanced and inherently responsive to the diverse needs and preferences of users with disabilities.



QUESTIONS & ANSWERS



THANK YOU FOR LISTENING!
LET'S KEEP IN TOUCH...



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