

Transcending Memories Beyond Borders: Carrying Memorabilia from Home to Abroad.

Transferring Personal Memorabilia for a Meaningful Cross-Country Experience.

Identifying Meaningful Methods to Preserve and Transfer Personal Memorabilia Across Diverse Geographical Contexts:

An Explorative Case Study Based on First generation Sri Lankan Migrants.

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Collecting memorabilia has been a longstanding practice as it evolved around cultures and societies. Despite existing research about preserving memorabilia, meaningful preservation methods remain unclear due to the individual and idiosyncratic nature of practices [18,22,40,43,47,59]. Migrants who collect memorabilia face challenges in preserving them due to unavoidable circumstances such as lack of transportation, physical measurements and weight of memorabilia. In 2020, 281 million people migrated globally, accounting for 3.6% of the world's population, and as this issue continues to grow, finding practical solutions is crucial [36,38]. The aim of this study is to explore ways to digitally preserve memorabilia to maintain their material qualities and meaning across diverse geographical contexts (RQ1). The study also focused on understanding what objects migrants regard as worth preserving (RQ2) and how digital memorabilia can be designed to serve as memory tokens (RQ3). The research employed an exploratory case study approach, focusing on first-generation Sri Lankan migrants [11,30]. Qualitative data was collected through interviews and the use of 3D printing and augmented reality was evaluated through prototype testing using a research-through-design approach [29,58]. Results revealed that souvenirs encapsulates sentimental, economic and aesthetic values that provides a symbolic meaning to its' owner and contributes to constructing their identity. Migrants were willing to try new technologies and augmented reality was recognised as a satisfying experience. To transfer memorabilia meaningfully among different geographical context, a holistic solution for memorabilia preservation was expected by migrants where physical protection of memorabilia is emphasized. Further research in this study involves utilizing photogrammetry scanning and 3D modeling to closely replicate real-life memorabilia and further evaluating mixed-reality user interactions such as augmented reality.

CCS CONCEPTS • Preserving memorabilia • Interaction Design • Innovative Design

Additional Keywords and Phrases: Migrants, Souvenirs, Culture, Preservation, Research through design, Materiality, Physical to digital, rematerialization, 3D printing, Augmented Reality, Identity, Symbolic Values

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1 INTRODUCTION

Collecting memorabilia is commonly practiced among different societies and cultures. Memorabilia practices are idiosyncratic, meaning it can depend greatly on the person who practice [36]. Memorabilia takes digital and physical forms such as souvenirs, diaries, photos, scrap books, stamp books, vinyl collections, collectibles, and many more. Preserving memorabilia is a common practice among people but due to the lack of available verities in preservation methods, many owners tend to gradually lose their precious old collections. Therefore, understanding needs of memorabilia collectors will help to introduce meaningful methods to preserve memorabilia and avoid losing one's precious collection.

Preserving physical memorabilia can cause them to deteriorate or be lost over time, and they may also be difficult to share or transfer due to physical limitations or distance [43]. To overcome these challenges, it's essential to consider how people preserve these items, such as using proper techniques and understanding conservation ethics [23]. Alternatively, preserving memories in digital format has become popular in HCI research because it's easy to maintain and provides reliable accessibility and protection against loss or damage, apart from allowing enhanced user interactions [13,18,20].

Recent research explores digital and physical mementos and identify behaviours related to collecting memorabilia [43]. Most studies in the field focus on preserving memorabilia through digital formats like audio and visual media; however, this approach is limited to capturing only the sense of hearing and sight, failing to capture the whole material experience of tangible objects [12,22,24,40,41,43]. Studies comparing digital and physical memorabilia indicate that collectors are open to utilizing digital technologies to organize and recall memories associated with tangible memorabilia [40,43]. Despite efforts to bridge the gap between physical and digital materials, new digital technologies, like Augmented Reality (AR), have not yet been evaluated in the context of memorabilia preservation [18,24,43]. As there is limited knowledge about preserving three-dimensional memorabilia objects digitally, it is necessary to explore methods of digitally preserving memorabilia, focusing on the materiality of physical objects.

As of 2020, the number of people living in foreign countries as migrants was 281 million, accounting for 3.6% of the world's population [38]. Migrants leave behind most of their precious belongings facing an emotional storm of "loss, alienation, xenophobia, cultural shock and nostalgic longing" [36]. To cope with such traumatic experiences, migrants tend to preserve memorabilia and create unique ways of relating to the past through special objects [36]. There is a vast number of people leaving their home countries trying to settle down in foreign lands who are going through "nostalgic feelings and episodic memories" [36]. Although there is extensive research on migration and physical to digital materiality, a notable lack of literature explicitly explores how these two realms converge [1,36]. Therefore, this thesis is aimed to find novel ways of assisting migrants to experience comfort through digitally preserving memorabilia in a more meaningful and accessible manner by identifying suitable methods for transferring them between diverse geographical contexts.

Being an international student who had to leave their homeland, I encountered the challenge of leaving behind sentimental objects that held great value to me. Though I had taken digital photos of these items, I realized that the essence of their physicality was lost. As a result, I aspire to delve into ways to retain the material and emotional attributes of memorabilia while preserving them to digitally transfer across multiple geographical borders.

The study evaluated the role of memorabilia in the migration experience by investigating which items migrants consider worthy of bringing with them to a new country (RQ2). Additionally, the study explored how digital memorabilia can serve as memory triggers (RQ3), shedding light on how memories are embedded in objects and

how these objects can help preserve memories across different locations (RQ1). The exploratory approach was selected for the research as it helps to gain knowledge by observing the existing world and discovering patterns to design new experiences in a focused context [30]. The study focuses on first-generation Sri Lankan migrants, a group that has been largely overlooked in research, and the type of memorabilia chosen for this study is souvenirs, as a result of the pilot study in section 3.1. Qualitative data was gathered by conducting interviews and creating a "Memory Box" prototype, which provided valuable empirical data to enrich the findings.

1.1 Research Question

The research will answer two sub-questions supporting a central research question.

1.1.1 Sub-questions

- RQ2: What types of objects do migrants consider to be worthy of preserving?
- RQ3: How can digital memorabilia be designed to act as memory tokens?

1.1.2 Main Research Question

- RQ1: How can we digitally preserve memorabilia to maintain their material qualities and meaning across diverse geographical contexts?

2 BACKGROUND AND RELATED WORK

This study is grounded in a multidisciplinary area since it encompasses memories, human perceptions, materiality, cultural studies, and modern technology. Therefore, previous literature and related work was studied to gather information on independent and intersected knowledge on different topics.

2.1.1 Defining Memorabilia.

A vast amount of past literature has been published to define and characterize memorabilia [2,4,7,22,23,41,42]. According to literature, Memorabilia could be referred to anything that triggers a sentimental memory to an individual [43]. Memorabilia is a broad term that represent a vast range of meanings. Souvenirs, Mementos, and Memory Objects are similar terms that refer to memorabilia objects that trigger memories of individuals.

Souvenirs can be "something that serves as a reminder" [22]. The word "originates from Middle French from (se) souvenir (de) meaning "to remember", which again comes from the Latin word subvenire meaning "to come up, come to mind" [22]. The definition of souvenir differs among dictionaries but overall, it conveys the same meaning as triggering memories by acting as tokens of memory [22]. An in-depth study about Souvenirs conducted by Van Den Hoven et al. revealed many important characteristics of souvenirs including the criteria for an object to become a souvenir, value perception, functionality and consumption [22]. The significant finding that souvenirs serve as memory triggers holds great relevance for this research.

2.1.2 Memorabilia as Tokens of Memory Evoking Nostalgia.

As Petrelli et al. explains souvenirs or mementos are not only representational but also carries a symbolic meaning which means that apart from keeping as a display object there is a personal story with an emotional value [40]. The criteria of selection of such objects are known to be symbolic and idiosyncratic because such reasoning significantly depend on individuals. Csikszentmihalyi and Halton conducted a study on how people attribute

meaning to objects and discovered that memories associated with those objects are what give them meaning and noted that a person's perception and identity heavily influence these memories [7].

Recent studies examined nostalgia as it relates to analog items, and a study on vinyl collections in a digital age found that nostalgia is a perception of belonging to a desired time [10]. It also discussed how nostalgia changes over time with generations in short periods. The nostalgic qualities also contribute to the symbolic value of objects, and such symbolic values evoke nostalgic thoughts in individuals and vice versa.

A study conducted by Marschall focused on "Memory Objects," which are sentimental items that hold special meaning for migrants and serve as physical tokens of memories associated with them [36]. It revealed that nostalgic longing contributed to new experiences among migrants, and over time, they developed new ways of relating to these special memory objects due to nostalgia [36].

2.1.3 Materiality and Tangibility in Memorabilia.

The importance of materiality and tangibility in memorabilia has been emphasized in previous studies [17,19,45,56]. These studies highlight the importance of the physical characteristics of objects and how they contribute to the preservation of the symbolic value of memorabilia [41,57]. Research on souvenirs identified physicality as one of the most important characteristics of a souvenir [22]. The physical and tangible aspects of objects are closely linked to their materiality [19].

"Materials experience" is a term which describes the experiences *with* and *through* materials" [17]. As Giaccardi's Material Experience Framework suggests, material experience is a dynamic relationship between people, practices and materials [17]. These interactions have different sensorial, interpretive, affective, and performative aspects. How people perceive materials also depends on their own perception which is vastly affected by socio-cultural influence [56]. Materiality of memorabilia is vital when it comes to preservation because the meaning of memorabilia also depends on how people perceive object's material qualities [57]. Studies reveal that people prefer to preserve objects that are special to them, in the form which they first encountered it with including physical traces of memory and historical values [55,57]. These material characteristics contribute to preserving the symbolic value of memorabilia by preserving the objects' originality.

In the context of digital materiality, maintaining material characteristics is a well-known challenge faced by HCI practitioners [16,56]. Previous studies were conducted about analysing digital and physical forms of objects that focused more on materiality and tangibility of objects [17,19,45,56]. These studies revealed that materiality of an object is highly associated with individual perception, practices, and physicality. Kedzior's study about digital materiality argues that rich conceptualization of real-world objects in the digital realm provides the same affordances to the users, called rematerialization [27].

Incorporating physical objects with digital systems can improve user experience, creating immersive and engaging interactions [24]. Tangible interactions, which blend physical and digital elements seamlessly, are known for providing users with an immersive, sensory-rich, and intuitive experience [37]. By combining the tactile feedback of physical objects with the convenience and versatility of digital interfaces, these interactions have become a keystone of modern user experiences offering a unique and engaging way to interact with technology. Incorporating material elements into the digital world contributes to the advancement of HCI, creating more holistic and embodied digital experiences [45].

2.1.4 The Role of Human-Computer Interaction (HCI) in Memorabilia Preservation.

The focus of HCI research is on exploring the potential of digital media to aid people in remembering things in their daily lives using memorabilia [22,23]. These studies centre around Ambient Intelligent environments, prioritizing memory cues, tangible user interfaces, personal memories, digital entanglement and overall remembrance [14,22,23,35,40,41].

A large part of the existing literature on preserving memorabilia focused on digitally preserving photographs considered valuable to individuals [39,43]. Previous research on preserving three dimensional memorabilia has shown that digital technology has difficulty supporting object preservation during the time of studies [20,43]. Early research by Frohlich involved a Memory Box prototype that enabled users to store physical objects along with an audio narrative and metadata for future access, revealing that the memorabilia's size impacts its preservation [16]. Recent studies are paving the way for more effective digital preservation methods using modern technology such as photogrammetry, 3D printing, Augmented reality and Virtual Reality [43,55]. In a more recent advanced study in the context of cultural heritage preservation, researchers managed to 3D scan large historical wooden sculptures and print the scanned objects as miniature figures using 3D printers [55]. The aim was to preserve decaying historical locations in digital forms and provide a novel user experience to expand the usability of cultural heritage sights. During this study the researchers also managed to preserve and reproduce physical characteristics that contributed symbolic and historical values such as traces, texture, and materiality.

When converting memorabilia into digital formats, it's crucial to consider how the process of capturing, organizing, and reflecting on the preserved items will be accomplished [26]. A study that evaluated a design prototype called "Memory Lane" elaborated more on how individuals capture memories, actively organize them and reflect on digital representations of mementos relating to people, places, and objects [26]. Further studies contrasting physical and digital aspects of memorabilia suggested three major aspects to consider when preserving memorabilia in digital formats [43].

- Broadening the set of digitally captured objects.
- Reducing the burdens of management and maintenance.
- Enhanced access to mementos.

These knowledge gaps are common for most memorabilia preservation related studies that unwraps design opportunities for HCI researchers [22,26,40,43,59]. Although research on remembering and digitally preserving artifacts continues, there is a significant lack of studies on the context of mementos of migrants. Therefore, this thesis focuses on gathering knowledge about how memorabilia is important in the context of migrants and how the materiality of those mementos can be maintained digitally.

3 METHODS AND METHODOLOGY

3.1 Pilot Study

Initially a pilot study was conducted on the domain to form the foundation for this research. This was conducted as an online survey among 12 participants who are first-generation migrants from different countries residing in Sweden. The survey consisted of open-ended questions which focused on finding what types of objects individuals consider to be sentimental and worthy of preservation and how important is the tangibility of such sentimental items. Souvenirs were chosen as the type of memorabilia for this research because when participants were asked to pick which memorabilia to preserve, souvenirs were the most frequently chosen option (Appendix 8.1.1).

3.2 Participant selection

This study included eight participants who are first-generation Sri Lankan migrants currently residing in Sweden, ranging in age from 28 to 40. The participants had different professional backgrounds that included IT related professions and non-IT related professions. The same participants were utilized throughout the study for interviews, design workshop, and prototype testing. All of the participants identified themselves as Theravada Buddhists [5]. Incorporating first generation migrants from Sri Lanka, specifically Buddhists which is an underexplored socio-cultural group, offered unanticipated insights into their socio-culture and enhanced the research findings.

3.3 Methods

Since this study intend to gather data regarding practices of preserving souvenirs, an exploratory research approach was chosen. Exploratory research enables HCI researchers to design new experiences by observing the existing world and discovering patterns which helps to gain knowledge in a focused context [11,53].

To gather empirical data, qualitative data gathering methods were chosen. Gathering qualitative data enables a researcher to gain insights to the problem space in multiple dimensions such as personal experiences, perceptions, and emotions of participants[31]. The study was conducted as an explorative case study because a case study helps to describe and explain behaviour of a narrowed sample such as Sri Lankan migrants and it also contributes to the credibility of results.

This research consisted of two main parts: in-depth interviews and prototype design. While interviews were focused on gaining deep insights of the domain, the prototype was focused on testing the experience of proposed methods. As Shneiderman explains, exploratory research findings can be used as a guide to build prototypes for experimental design [29,49]. Prototyping followed research through design approach as it tackles "wicked problems" that possess diverse causes, effects, and perspectives through use of interactions. [58]. This is further explained in section 3.5.

3.4 Part 1 – In-depth Interviews

The first part of the study focused on gathering qualitative data through in-depth interviews since in-depth interviews provide more insights into the interviewee's perceptions [8,31]. Direct conversations which lead to describing different perceptions of individuals was highly important in this case study to gather qualitative data in a deeper level. Each participant was individually interviewed in a one-on-one setting, lasting approximately 30-60 minutes. The interviews were semi-structured (Appendix 8.1.2) and gave the interviewees the independence and opportunity to provide longer and detailed opinions. Some questions were focused on personal histories that described memorabilia related practices while other questions formed guided speculations about possible technological innovations to gather a broad set of data. The conversations were carried out in informal language to make participants comfortable with sharing their information.

Interviews were recorded as audio/ video with the consent of the participants followed by practices of data protection and maintaining anonymity. Gathered qualitative data was analysed using inductive thematic analysis method to identify emerging patterns formed in the context [8,32]. MAXQDA software was used to efficiently analyse and code the qualitative data and introduce clusters and visual code maps following thematic analysis method [60] (Appendix 8.1.2).

3.5 Part 2 - Prototype Design

Since the aim of this study is to identify meaningful methods of digitally preserving souvenirs of migrants, the second part of the study followed research through design approach by designing and evaluating a prototype that lets users preserve their souvenirs digitally. As stated by Zimmermen and Frayling, research *through* design can be used to gain more knowledge of “wicked problems” through the use of interactions [15,29,58]. A prototype allows designing and experimenting with different design solutions to evaluate strengths and weaknesses [46,53,58]. The tested solutions provide the opportunity for the designers to make informed design decisions early because the users can test the design in an early stage. Double Diamond model (DDM) was used for the prototype design process due to time constraints and because DDM is highly compatible and proven to produce effective results in short term projects [53,61].

3.5.1 Prototyping based on the Double Diamond Method

In DDM model the first diamond represents studying the problem space, and the second diamond represents designing solutions. The details of these two stages are explained in the following sections.

3.5.2 First Diamond – Discover & Define problem space

During the beginning of the first diamond, the problem space was thoroughly researched to identify potential design problems and opportunities through in-depth interviews. As part of the interview, the participants were tasked with answering the last two questions to stimulate their creativity and generate potential solutions for the issue at hand. In addition, a design workshop was conducted to generate the initial design ideas by co-designing with participants.

3.5.2.1 Design Workshop for co-designing with participants

Co-creating designs with real user groups assist the designers to build satisfactory user experiences because designing “*with*” users adds the component of empathy while it is constructed rather than designing “*for*” users [6]. To create an effective and user-friendly prototype, this research utilized participatory design methods such as design workshops, brainstorming, and ideation. These methods allowed for co-designing with participants, resulting in the gathering of pragmatic knowledge [3,54].

The workshop was organized with a futuristic design approach to identify potential technological solutions for the problems at hand. Such futuristic workshops enable exploring a large range of opportunities and elaborating on the impacts those might have on the users. [25,44]. The goal of the workshop was to explore *innovative ways of preserving memorabilia related to the migration experiences of Sri Lankan communities*. For the workshop, six participants were selected from the eight interviewed participants. Three of the participants had a profession related to IT/Design and others were non-IT professionals. All participants were technologically literate. The workshop agenda is presented in the appendix 8.1.4.

The workshop adapted to the divergent and convergent concepts of DDM model. Initially the participants were taken into a divergent phase where they had to ideate using individual brainstorming. Users were asked to note their solutions under main themes found from the interview data (

Figure 1). During the convergent phase the ideas were narrowed down into feasible solutions by working together in two groups to generate two possible use case scenarios on designing novel methods to preserve

souvenirs digitally (Figure 3). To assist participants with ideation and empathising, ten picture cards of modern technologies and six sample souvenirs were provided (Figure 2). The findings are presented in appendix 8.1.5.



Figure 1. Brainstorming ideas individually



Figure 2. Introducing Picture cards and souvenirs



Figure 3. Brainstorming in two groups to create two possible user scenarios.

3.5.2.2 Design Workshop Analysis

The problem space was narrowed down by converging generated ideas into a manageable scope depending on the available time and feasibility by defining a scope and making design decisions based on data analysis. The data collected from the design workshop was analysed to identify use cases (Figure 4), and a SWOT analysis was conducted to make informed design decisions (Appendix 8.1.6). Empathy maps and personas were also constructed to empathise with the users in order to design the prototype (Figure 5).

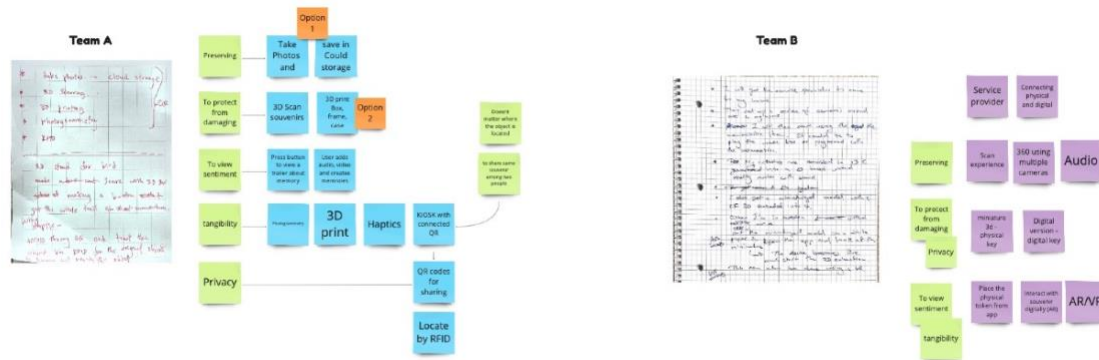


Figure 4 Use cases generated by two participant groups.

Bringing souvenirs



NNGROUP.COM NN/g

Personas

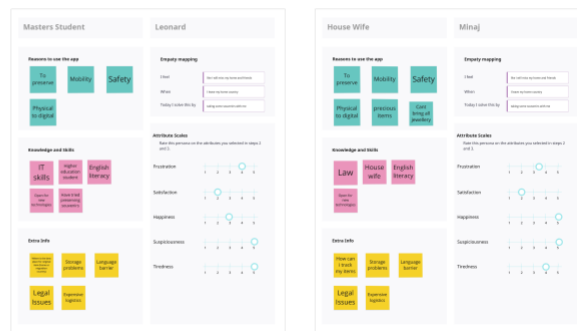


Figure 5 Empathy Maps and Personas

3.5.3 Second Diamond – Develop & Deliver solutions

The second part of this research focused on identifying digital methods of memorabilia preservation that would provide the participants with a meaningful experience. The design process also followed DDM method which employs design thinking to generate innovative ideas [61].

3.5.3.1 Prototype Design

Based on the findings of the first diamond phase (Appendix 8.1.6) which included main themes generated from interviews, use cases, SWOT analysis, empathy map, and personas a prototype was designed prioritizing on the user-oriented participatory design approach [54]. Apart from primary data, secondary data which provided design guidelines for digital mementos were also considered as an inspiration [43].

An interactive high-fidelity prototype was designed using design tools: Figma, Anima and Vectary [62–64]. A 3D scanning photogrammetry mobile app called Polycam was used to mimic the scanning functionality [65]. Scanned 3D models were 3D printed using Cura software as a part of the prototype as shown in Appendix 8.1.9 [66]. The prototype consisted similar objects to the souvenirs participants mentioned during their interviews to facilitate empathy during testing. The proposed solution was a mobile application named "Memory Box," which consisted of the main features listed below.

1. Memory Stories (Figure 6)

- A carousel user interface displaying souvenirs randomly along with related information about memories.
- Enables upcycling the souvenir in various forms.
- Enables re-purchasing similar items.

2. Detailed Views (Figure 7:b)

- Saving souvenirs with associated memories using multimedia formats: audio, text, video, images.
- Enables requesting a 3D replica of the souvenir (3D print).

3. Interactive digital souvenir replicas (Figure 7:c, d)

- Displaying an interactive scanned 3D model of souvenirs.
- Using AR technology to provide an immersive mixed reality experience to interact with scanned souvenirs as digital 3D objects.

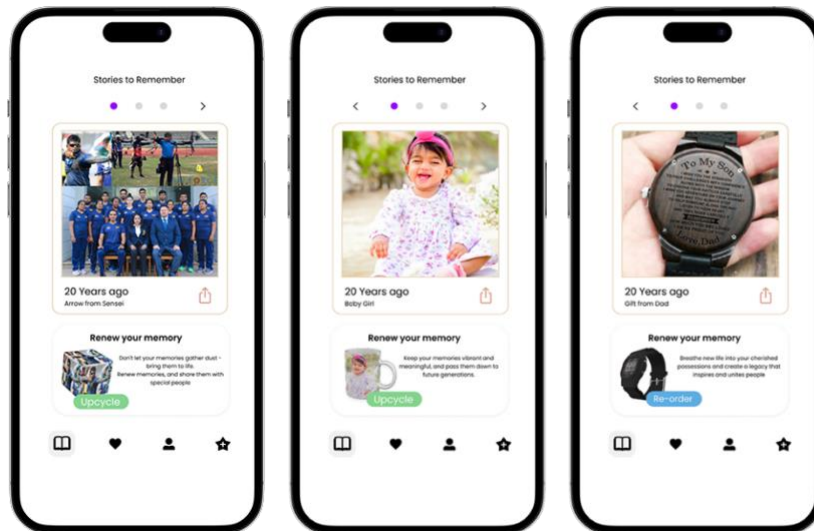


Figure 6 Memory Stories designed to evoke recollections of cherished items, functions include sharing, upcycling etc.

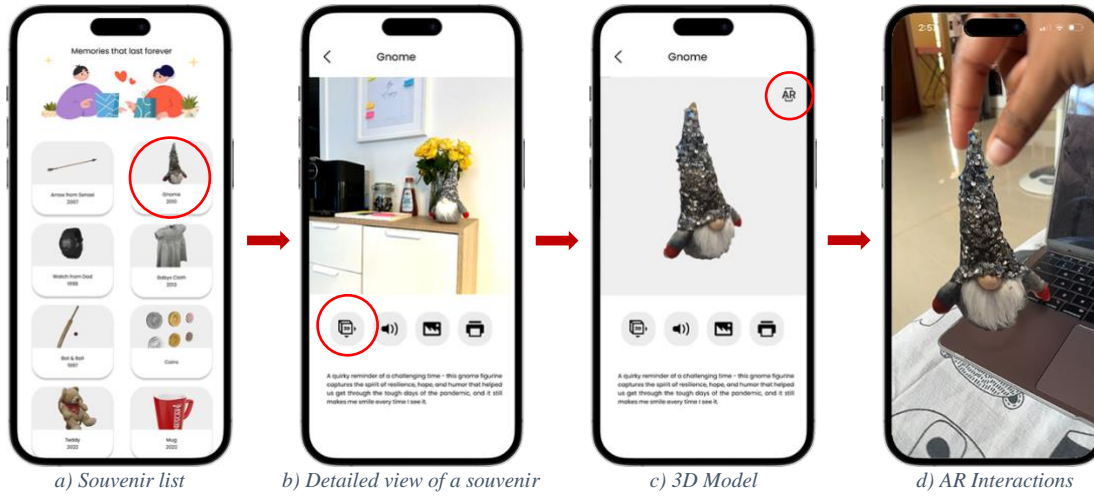


Figure 7 AR-enabled digital souvenirs for users to engage with (Use case denoted in red)

3.5.3.2 Prototype Testing

User-oriented design provides design researchers the opportunity to understand current and future needs of user through iterative cycles of prototyping and testing [54]. The designed prototype was tested using the Wizard of OZ approach (WOZ) which lets the researchers test prototypes on an early stage by asking users to try imaginary scenarios and material enabling them to empathize and test the solutions [53]. Prototype was tested among two focus groups consisting of three and two participants, respectively due to participant availability. The users were asked to test the prototype using three interactions.

1. Home page: Testing the memory stories which were displayed in the homepage.
2. Viewing Souvenir: Testing the experience of a 3D print, AR and multimedia of souvenirs.
3. Adding Souvenir: Testing the 3D scanning photogrammetry method.

After interacting with the prototype, users were asked to express their likes, dislikes, unexpected experiences, improvements, and frustrations (Appendix 8.1.10). The answers were translated and transcribed as a summary and facial expressions were also observed. Data was analysed to identify interesting themes and the results summary is presented in section 4.2.

4 RESULTS AND ANALYSIS

The following section presents results of two main parts of this study: interviews and prototype testing.

4.1 Key Themes Emerged from Interview Findings

The in-depth interviews conducted among participants provided insights to practices related to memorabilia among Sri Lankan first generation migrants. The participants were questioned regarding opinions and practices related to souvenir collections. Analysed interview data formed six main themes.

Table 1 Themes Evidenced in Interview Analysis

Main Themes	Sub-themes
1) Preserving for future	<ul style="list-style-type: none"> Proximity and Attachment, Mobility Upcycling Different levels of interest overtime Willingness to Explore New Technologies
2) Value of souvenirs	<ul style="list-style-type: none"> Value Types: Sentimental value, Economic Value, and Aesthetic value
3) Memories and associations	<ul style="list-style-type: none"> Forgetfulness and remembrance Souvenirs as memory tokens
4) Loss and frustration	<ul style="list-style-type: none"> Protection of souvenirs
5) Protection	<ul style="list-style-type: none"> Privacy and Sharing Physicality
6) Individual Beliefs	<ul style="list-style-type: none"> Socio-cultural influence

4.1.1 Preserving for future

All the participants expressed their interest in preserving souvenirs for future references. When asked why they would collect memorabilia the answers explained how they would like to preserve positive memories in order to recall them in the future.

“To look at those one day, when I'm alone. Like when I look back, I can think and recognize I had a past like this and reminisce. (P3)”

It was apparent that the intention of preserving souvenirs was to reflect on the past and reminisce in the future.

“If I feel like I need to keep something that I like, I put it inside a file or something, if I feel like in the future, I would be able to smile at it, appreciate it ~ Either look at it, touch it or think about it and think about its history or events and smile, laugh, appreciate (P6)”

Participants considered their souvenirs as memory tokens that represented a person, a place or an event which helped them reflect on a particular memory.

“...something I received on a special occasion. And I want to remember that I value it. I would wanna remember that because its special. If I can see it again. I'll be happy (P1)”

Sub themes are explained below.

4.1.1.1 Proximity and Attachment

Given the opportunity participants preferred to carry their close memories along with them to the country they were migrating to. But due to lack of facilities, legal concerns, and expensive luggage services, they were hesitant to bring their souvenirs along with them to migrating country.

“It’s my hard work. We don’t know what’s happening at the airport. Like they’d ask me why I’m taking so many coins and notes and it would become a legal issue.” (P1)

This led to another sub-theme “Mobility” because of the inadequacy of transportation methods available for migrants.

4.1.1.2 Upcycling

This was another sub theme that generated under the theme of future preservation. Participants suggested that upcycling would help them to preserve their souvenirs in an interesting manner just by changing the structural form or materials in a way that the original object becomes transportable. During the process of upcycling, the originality, size, and the traces of the item were considered important to maintain.

“When I was talking with you, I was realizing the fact that there’s so many ways you can use the same object to preserve it in another form. Which I really didn’t think about before. And I was reading about this article about this particular Japanese art which I can’t recall the name right now but when something is damaged ~ they build it back using that gold gum and once you do that it apparently has like millions of dollars’ worth. ~ And I was thinking like recreating something out of something, ??? it would retain the same form it would increase the value and increase the aesthetics about it and also the ownership will be stronger...um... I think that would be a very nice way we could preserve something because you put something more to it. Like you add more value to it than it was initially... I think that would be a very nice way to preserve” - (P2)

The idea of upcycling souvenirs was influenced by **Japanese Kintsugi art** [28], as shared by a participant. Although this practice is rare in Sri Lanka, the participant introduced it to enhance the appeal and appreciation of souvenirs. The participant believes that upcycling while preserving originality saves space and increases the interest and value of objects. Additionally, the participant emphasized the importance of considering the materiality and functionality of the original objects.

“Yeah, if I created a flower basket out of my bamboo arrows, I don’t think there would be a satisfaction coz its bamboo. I think I should have the same kinda thing that could trigger memories when I see it.” - (P2)

As he explains, upcycling an object to a different function has the risk of destroying its originality and sentiment due to overriding of mental models and perceptions.

4.1.1.3 Different levels of interest overtime

Participants showed different levels of interest on memorabilia overtime. They were explaining how their interest towards memorabilia changed as they grow older and how such souvenirs became more important, or less important. Several participants expressed how their interest in a souvenir changed overtime which made them rethink its value.

“I might even have the university card now, but I don’t value it really. Yeah. I have come to that point.” (P6)

“Well, the stuff dad gave me, I lost interest when I grew up and it became old fashioned, so I exchanged my gold. Even the necklaces Daniel bought me. I upgraded the design. I don’t stick to one thing. My taste changes.” (P8)

“Yeah, with time it has changed. There are somethings that maybe with time or maybe because I’m getting old ~ for example if there’s something I bought or something I received, sometimes after a while I think I’m collecting this, but it doesn’t mean anything.” (P1)

In contrast to losing interest, some participants demonstrated that their interest in the souvenir grew unintentionally over time.

“I had ~ official event ID s ~ I had around hundreds of them. I collect those just to know I’ve done it and gradually there was a lot and I started collecting them. It wasn’t special at first, but after collecting one or two I thought I should collect the ones ahead as well.” (P7)

This explains how participants are aware of changes in their own perceptions about life and meaning of things as their personality evolves with time.

4.1.1.4 Willingness to Explore New Technologies

All participants were open to new technologies when preserving memorabilia. While they were open to digitally preserving souvenirs, they all emphasized the importance of having both digital and physical options. A few participants proposed utilizing 3D printing technology to create replicas of souvenirs, although they needed to be more particular about the technology’s current capabilities. Additionally, participants expressed various other technologies of their interest.

- Virtual reality environments where users can organize and access digitally stored souvenirs.
- Using haptics to touch the souvenirs remotely.
- Micro level 3D printing.
- Souvenir preservation as a holistic service that includes tracking and remote monitoring.

4.1.2 Value of souvenirs

All participants expressed their emotional attachment with souvenirs. All of them mentioned how souvenirs has an *emotional value* attached with it and how they try to preserve it. This emotional value was directly related to their memories about particular people, place, or an event.

Analysing this emotional value further, few sub themes formed about other aspects of this emotional value: **Sentimental value, Economic Value, and Aesthetic value**. Sentimental value is where they focused more on the emotional attachment with the souvenir that formed **nostalgic memories** related to people, place, or event. Economical value is where the participants were concerned about the **monetary value** of the souvenir which contributed to have a strong emotional value with the item. Aesthetic value of an item can be explained as when the participants appreciated **artistic perceptions** of the object.

4.1.3 Memories and associations

When participants discussed about souvenirs, they narrated stories about memories associated with the corresponding souvenirs. These stories acted as memory tokens for their past and the special people around them which contributed the souvenirs to become important for them.

Sub themes are explained below.

4.1.3.1 Forgetfulness and remembrance

Some souvenirs were eventually forgotten and misplaced due to lack of protection and accessibility. Even though they were not fully forgotten, participants were contemplating if those memories are forgotten. Yet they kept recalling incidents and related stories to such souvenirs they claimed to be “forgotten”.

Most of the souvenir’s participants kept were associated with a special person and the relationship with that person also significantly affected the souvenir.

“I mean with time, if I get into bad terms with someone, I might even discard it. I mean it depends on the situation. (P3)”

The reason a memory can be negative is dependent on the individual's relationship with the person or event connected to the memorabilia.

4.1.3.2 Souvenirs as memory tokens

Participants also talked about how souvenirs helped them to trigger memories. This trigger was mostly randomly occurred, and they preferred to keep it that manner. Participants wished if they could receive more random triggers that will cause them to remember and reminisce associated memories often.

4.1.4 Loss and frustration

All participants had to leave most of their precious belongings in Sri Lanka due to travel constrains.

“My dad used to collect coins and notes and I continued after him. And today I don't have it with me. I really loved doing that, whatever new coin or note Sri Lanka released I used to put that into my collection, but today I can't do that. I miss it.” (P1)

Apart from such items, they described souvenirs that were fading from memories which caused them frustration. Most participants mentioned they were sad or frustrated because they either lost some souvenirs or had to leave them behind.

*“But now, after coming here, those cards might be somewhere at home and getting damaged(fungus). I don't even remember the place really. Most of the time if I lose one of those things, I would be losing something so valuable and now that really struck me that **** I should have tried to preserve this. (P2)”*

Frustration was an outcome of the emotional values related to the souvenirs and this was considered as a main theme due to its significant effect on the participants emotional reactions. All participants expressed great loss or frustration which they wished they could avoid.

4.1.5 Protection

Participants were highly concerned about the privacy and protection of their preserved memorabilia.

“And another day a kid came and messed up the box and things were damaged. And I don't really like that. If I could have kept it in a safer place... I just wish. I don't like that. I just need things to be safe.” (P1)

When they were asked where they normally keep the souvenirs everyone responded that they keep it in a safe place, either inside a display cabinet where everyone could see it or safely stored inside their Almirah. This practice

of storing was common among all participants, but they selected different souvenirs to store and preserve according to their personal preference. Sub themes are explained below.

4.1.5.1 Privacy and Sharing

Participants were selective about whom they are sharing their souvenirs with and who has access to these objects. They were confident that keeping access only to themselves would protect the souvenirs from being destroyed in unanticipated ways. Talking further about the protection, participants discussed in detail about protecting the physicality of objects such as traces and the original item condition.

4.1.5.2 Physicality

During the discussion about protecting and preserving souvenirs, participants focused on the physical characteristics of the objects, including weight, material, size, and tangibility. The weight of a souvenir was seen as key to its originality, setting it apart from its material and tangibility. Participants shared how holding a souvenir brought them joy and how the physical traces preserved memories from the past. It was agreed that preserving these material traces was crucial to maintaining the authenticity of the souvenir.

Participants emphasized the importance of the physicality of souvenirs, particularly their tangibility, and expressed a preference for objects that could be held and touched. They were opposed to the idea of solely having digital copies. Furthermore, many participants were concerned about the size of souvenirs, as they often presented storage and transportation issues.

4.1.6 Individual Beliefs

Apart from main themes explained above, participants expressed their beliefs and perceptions related to memorabilia collection. When asked if there is a difference in the practice of memorabilia collection across generations and cultures, they were confident that there is a significant difference.

“Definitely its different. Coz there are things that religiously we would think there’s no point collecting this coz things don’t last forever so we might not collect. And another person might think these things are fake and they wouldn’t collect. (P1)”

Since all the participants were Buddhists, they also believed that minimalism is important. Detachment and decay were considered normal. One participant expressed strong interest in minimalism that was influenced by religion and society.

“According to Buddhist philosophy I feel like it’s useless, and collecting things so much feels like a waste. If I don’t use it, it feels unnecessary, its Minimalism. I don’t use two mobile phones. I don’t need three mugs; I just use one mug. And also, I feel like I have a responsibility to be sustainable. Sweden changed my mindset. When I lived here, I got the cultural influence and learnt a lot about sustainability. I’m obsessed with sustainability now (P4)”

One participant believed that western society tends to collect more memorabilia than Sri Lankans based on her personal experiences. All participants believed there is a generational difference in the practice of memorabilia collections apart from cultural differences.

4.2 Prototype Test Results

Test results from the mobile app prototype “Memory Box” are presented in this section.

Table 2 Overview of Prototype Test Results

Memory Tokens	<ul style="list-style-type: none">• Memory stories were helpful to trigger memories.• Users preferred customizing the number of memory stories.• Users preferred attaching related information to the objects.• Users suggested adding a unique notification sound to memory stories.
Protection was anticipated	<ul style="list-style-type: none">• Users suggested incorporating a business model to provide protection as a service.• Privacy is important when sharing and saving souvenirs.• Users prefer leaving objects in home country and carrying a replica.
Technological preferences	<ul style="list-style-type: none">• Users prefer AR over 3D print for interaction.• Photogrammetry scanning was interesting for the users

4.2.1 User Satisfaction with Augmented Reality (AR) Experience

All users were enthusiastic about the AR’s immersive experience with the souvenirs, which they found to be the most satisfying feature of the app.

“Got a great emotional connection. I used to think the physical feeling was more important than the digital feeling, coz I thought maybe my use case was different than the other ones ~ coz I was thinking about the texture like feathers and stuff I thought it’s almost impossible, but if this is my object, I mean the material and the texture: it would be so good And I really felt like touching. Also, I don’t wanna keep it with me 24/7 so the exposure I got was more than enough. Like just being able to take a look when I need for few minutes and watching it on AR didn’t really have a gap(difference) for me. It felt real. It was so realistic than I imagined. It’s a real feeling. I even got the tangible feeling even if it wasn’t tangible and the emotional connection was big. (P2)”

As shown in Figure 9, it was observed that both focus groups tried to physically interact with digital objects while using AR technology. Additionally, users’ facial expressions conveyed a higher sense of happiness and excitement during AR interactions.

4.2.2 Enhancing 3D Printing Technology for Improved Results

To compare the experiences of AR and 3D printing, the prototype included a scanned 3D digital model and a printed physical 3D model of a souvenir, and the users interacted with both objects. 3D prints were given to them in two different sizes and colours (Figure 8). Users were contemplating about the experience of 3D print and expressed less interest in touching and holding the items. They mentioned that if the 3D print can closely resemble details of the original object such as traces and materiality, they might feel the interest of having a 3D print. Users were concerned about the missing details in the provided 3D models, and they described how materials are important to gain a better user experience. An interesting finding was that the size of the 3D printed object did not matter for all users. They mentioned that it is more desirable to reduce the size and weight since it is only a token to access memory. But they demanded to maintain the traces and fine details of original object to be replicated.



Figure 8. 3D prints, Real object, User testing

Users showed a preference for AR over 3D when asked to compare the two experiences. This was due to the lower quality of the 3D items provided and the higher quality of AR. A few users were open to the idea of having a 3D print as upcycled material only if the quality of 3D print would increase.



Figure 9. AR testing: Users trying to hold digital objects with enthusiasm.

4.2.3 User Satisfaction with Photogrammetry Scanning Process

This method of scanning was interesting for the users. Users were not hesitant to make an effort to scan using photogrammetry and one user mentioned the act of scanning was satisfying.

“I was thinking that just the scanning function itself would give a very fulfilling feeling. I mean whether you watch it or not, coz it’s like I try to preserve it on my own. It’s not like I’m watching something that others try to preserve. So even if I don’t watch it often, the preserving act itself is very satisfying (P2)”

Users were concerned about whether they would have a consistently positive experience when repeatedly using the scanning process. However, since the scanning feature is meant to be used infrequently and is mainly intended for use during the migration process, users were content with the effort put into scanning souvenirs. Scanning was also seen as a viable option since many users could not bring their items due to various obstacles and personal circumstances.

4.2.4 Recalling Memories: User Satisfaction with the Memory Stories Functionality

Users were satisfied by the experience of memory stories (Figure 6). They were open to the idea of sharing memories with selected audiences or special people. Having memory stories on the homepage helped them trigger memories related to souvenirs. Participants suggested this function could be improved further by adding more user interactions to the app such as a unique notification sound.

4.2.5 Associated Memories: User Satisfaction with Detailed Views of Souvenirs

Users were satisfied with grouping related memory data together. Being able to view different media of the same object helped them to trigger more memories and enrich the user experience. When grouping all related media, they were not interested in combining two 3D models together in the existing app, but they preferred to have links to access related memories. Participants suggested they would prefer a virtual space similar to a cupboard or a rack to organize their souvenirs.

4.2.6 Anticipated Protection of Souvenirs: Physical and Digital Approaches

Users were still concerned about the protection of original object and suggested the need of having a holistic service provider to take responsibility of the protection of souvenirs. This was an important concern for all the users. Apart from the physical protection, users were concerned about access levels and authorization to the app to secure the digital objects.

5 DISCUSSION

The study focused on finding meaningful digital methods to preserve souvenirs of first-generation Sri Lankan migrants. Qualitative data revealed valuable insights about characteristics of items they consider sentimental, illuminating the path to understanding the needs of first-generation Sri Lankan migrants regarding preserving souvenirs. Below are the main themes presented, which are aligned with the findings of similar studies on memorabilia [16,22,47].

Table 3 Engaging Themes Elicited from Qualitative Data Analysis

Values embedded in souvenirs	<ul style="list-style-type: none">• Symbolic Values: Sentimental value, Economical Value and Aesthetic value.• Memories of associated people, places, or event.
Practices and emotions related to souvenirs	<ul style="list-style-type: none">• Souvenirs are preserved for future access.• Loosing and forgetting souvenirs caused regret and frustration.
Technological Solutions and Design Recommendations	<ul style="list-style-type: none">• Participants were willing to use new technologies to preserve souvenirs.• Materiality is crucial for transferring memorabilia from physical to digital.• Protection and physicality of souvenirs are important.

5.1 Souvenirs are tokens of memory representing a symbolic value.

When discussing the central themes concerning values, souvenirs are important to their owners for sentimental, economic, and aesthetic reasons and hold memories of people, places, or events that add to their symbolic value. The collected items always held a symbolic meaning from the collector's perspective. Assigning a symbolic value to objects can be explained through the lens of semiotics and symbolic values [7,34]. As Csikszentmihalyi and Halton

describe, when a piece of information is recognizable and has a distinct identity in our minds that enables us to identify patterns or structures, it can be called a sign. These signs are encapsulated in objects providing meaning to people. According to Baudrillard's perspective, people add more value to such signs based on their perceptions, called symbolic value [34]. For example, a teacup could have a sign value of a function, but the same teacup would hold a symbolic value as a symbol of friendship. The symbolic value of an object refers to the emotional attachment assigned to it by collectors as souvenirs. This sentiment may shift over time as evident in results (4.1.1.3 Different levels of interest overtime). Participants gained or lost symbolic value towards items over time.

When it comes to souvenirs, their emotional value is important because people attach special meaning to them (4.1.2 Value of souvenirs). Participants in this study gained memories associated with their souvenirs, triggering different emotions, including nostalgia, a perception of time that makes someone need to belong to another time beyond the present [10]. Since the participants were migrants who had left their precious belongings behind, they expressed a great deal of nostalgia which supports Marshall's finding that states that migrants have a sentimental attachment to memory objects [36].

As presented in results (4.1.3: Memories and associations), some participants desired for forgetfulness of memories. When they shared stories about their sentimental items, some participants expressed interest in letting go of unnecessary memories. Therefore, it is important to strike a balance between remembrance and forgetfulness when designing for memorabilia. Forgetfulness is considered undesirable by humans, yet remembering everything could lead to severe information overload [23]. As such, it is essential to provide users with the ability to discard unwanted memories while retaining the ones they cherish.

Moreover, Participants were interested in the presented narrative as it helped them to remember and arrange episodic memories in a chronological sequence while retaining symbolic value enabling them to recall personal experiences (Appendix 8.1.5). Therefore, designing for memorabilia should consider the narrative of the memorabilia presented to users to provide a more meaningful experience.

5.2 Memorabilia collection practices are idiosyncratic, expressing individual identity reflecting socio-cultures.

Participants in the study displayed an idiosyncratic nature when collecting and preserving memorabilia. They deliberately chose what to keep based on personal values tied to their identity, interests, and lifestyle. This insight is crucial to consider when designing for preserving memorabilia.

One of the participants stated that she collected jewellery primarily for its economic value, while the others collected souvenirs with sentimental significance. From the participants' perspective, they felt honoured by the monetary value their collections brought them, as it gave them a sense of ownership in their lives. The souvenirs people collected and their perceptions towards the souvenirs enabled them to build an identity [10,50]. This was apparent in Csikszentmihalyi and Halton's study about household collections among families where they explain how people derive status from collected objects [47]. This status of objects depends on a symbolic context that owners perceive in comparison to others which is called *symbols of status* [47]. Ownership of such symbols of status is perceived as a way of expressing their identity and reveals the social classes to which they belong in society. Likewise, owning a collection of gold jewellery can elevate an individual's social status and identity due to its symbolic significance in society. While some people value these symbols of status others valued the emotional significance of souvenirs.

This study further revealed social and cultural factors impact how individuals gather memorabilia and construct identity as showed in results (4.1.6 Individual Beliefs). Participants shared their beliefs which were influenced by

the Theravada Buddhist religion commonly practiced in Sri Lanka. According to Buddhism, material possessions are impermanent and will eventually deteriorate [5]. Theravada Buddhism promotes living in the present moment through mindfulness, known as "the middle path of living" [5,51]. This philosophy also emphasizes detachment as a way to avoid regret and frustration, leading to contentment [5]. Participants shared how their Buddhist and Sinhalese cultural backgrounds influenced their habits of minimalism. Their religion and culture played a significant role in shaping their perceptions of life, demonstrating how cultural and religious influences impact their desires, beliefs, and worldview, aligning with the social identity theory where they express the knowledge of belonging to a social category or group [52]. The participants viewed their religion as a crucial aspect of their identity. Although participants attempted to collect fewer memorabilia due to religious influence, all participants had a significant amount in their collection that they were unwilling to risk damaging or losing. Despite facing obstacles, first-generation Sri Lankan migrants have shown determination in bringing their memorabilia to Sweden. This starkly contrasts Marschall's research, which discovered that first-generation African migrants chose to leave their memorabilia [36].

When designing for memorabilia, it is important to consider how it expresses an individual's identity. The design should allow for personalization and customization of content and provide the ability to share data publicly or privately with other users. This allows users to express their personal preferences and construct their identity in conjunction with society. To create a customized user interface design, it's important to take socio-cultural influences into account [33]. This includes applying design principles like minimalism and colour psychology that align with the preferences of different societal groups, which may be influenced by religion.

5.3 Exploring Technological Solutions and Design Recommendations for Preserving Memorabilia

As noted in results (4.1.1.4 Willingness to Explore New Technologies), participants were willing to embrace new technologies despite their differing personalities, consistent with prior research [23]. While previous studies found success with 3D models [55], participants in this case study regarded 3D printing unsuccessful due to its lack of accuracy. However, they appreciated the lightweight nature of the 3D prints, which allowed for increased mobility. Enhancements in technology, such as 3D printing, can potentially improve the material experience of souvenir preservation [23]. Presented below is a summary of the main themes and corresponding design recommendations.

Table 4 Summary of design suggestions for preserving memorabilia.

Category	Theme	Design Recommendations
Values embedded in souvenirs	<ul style="list-style-type: none"> • Symbolic Values: Sentimental value, Economical Value and Aesthetic value. • Memories of associated people, places, or events. 	<ul style="list-style-type: none"> • Consider multimedia formats that engage multiple senses, including video, audio and other embodied experiences when preserving the symbolic value of memorabilia (Video, Audio, AR, VR Mixed reality etc). • Memory triggers should be included to trigger memories randomly. • Remembrance and forgetfulness must be balanced to avoid information overload. • Narrative is important for uses to maintain memories and associations.

Practices and emotions related to souvenirs	<ul style="list-style-type: none"> • Souvenirs are preserved for future access. • Loosing and forgetting souvenirs caused regret and frustration. 	<ul style="list-style-type: none"> • Design must allow customization and personalization to represent user's idiosyncrasy, identity, and social cultures. • Physical protection of memorabilia must be handled apart from privacy and protection of digital media.
Preferences for designing Souvenir preservation	<ul style="list-style-type: none"> • Participants were willing to use new technologies to preserve souvenirs. • Materiality is crucial for transferring memorabilia from physical to digital. • Protection and physicality of souvenirs are important. 	<ul style="list-style-type: none"> • Immersive technologies such as AR and Photogrammetry scanning was appreciated by users. • Users' actions and behaviours with materials varies depending on digital or physical. • Considering the physical aspects of materials is paramount when transitioning to digital formats. Traces, size, texture, and weight must be considered to increase precise rematerialization. • The lightweight replicas of souvenirs will facilitate mobility. • A holistic service to preserve memorabilia was expected by users.

5.3.1 Evaluating material experience of memorabilia.

When preserving memorabilia, it's essential to assess the materiality of objects to determine which material aspects are necessary to maintain their digital materiality [19]. This section explores the materiality of souvenirs from the perspective of Giaccardi's materials experience framework which was discussed in the section 2.1.3.

5.3.1.1 Sensorial Level

Souvenirs provide a variety of sensory experiences, including texture, smell, and colour. During discussions about their souvenirs, participants mentioned specific material details such as the softness of feathers, transparency of glass, and texture of bamboo. All participants recognized the importance of maintaining the sensory materiality of souvenirs when preserving them. However, it was discovered that participants were not concerned with replicating the weight and size of the original souvenirs in replicas. Instead, they prioritized the mobility of the souvenirs.

5.3.1.2 Interpretive Level

In sections 5.1 and 5.2, it was explained that the meaning of souvenirs for participants was linked to memories relating to individuals, locations, or occasions that held symbolic importance for them. This symbolic value was influenced by their personal identity, history, and socio-cultural background. Positive relationships were more valued in souvenir items than negative experiences. Cultural and religious beliefs also affected people's perception of souvenirs.

5.3.1.3 *Affective level*

Talking about souvenirs made participants feel nostalgic. They experienced nostalgia and various emotions, including happiness, positivity, and longing. However, remembering souvenirs left in their home country made them feel insecure about protecting these items, which caused frustration. This insecurity prompted discussions about the importance of physically protecting souvenirs, as discussed in sections 4.1.4 and 4.1.5.

5.3.1.4 *Performative Level*

The way people interact with materials varies depending on whether they are physical or digital. When preserving souvenirs, participants tend to collect and organize more items in their home country, likely because of limited space when they migrate. How souvenirs are displayed or hidden also varies based on their symbolic value and privacy. These observations are essential when designing digital storage for souvenirs, taking into account privacy and sharing.

During the interaction with the 3D print, participants expressed dissatisfaction with its precision and focused more on achieving an accurate replica. They compared the physical texture and details of the original object with the 3D print. Eventually, all participants lost interest in the 3D print as a souvenir due to noticeable differences from the original object. Instead, they suggested using a 3D print as a display in close proximity to trigger memories of the original object.

Participants interacted with augmented reality 3D models and attempted to touch and engage with them (Figure 9), leading to rematerialization of digital artifacts [27]. This phenomenon requires further study, as participants preferred digital 3D models over 3D prints. This aligns with Kedzior's argument that accurately conceptualizing objects from physical to digital preserves their original material qualities [27].

5.4 Limitations & Ethical Considerations

This research was conducted as a case study among eight participants and it is important to remember that the knowledge gained might be idiosyncratic just as in any case study [30]. Further research must be carried among larger sample groups to generalize findings.

On the one hand, since participants came from a similar religious background, it is important to consider different religious backgrounds to validate socio-cultural effects when selecting participants for further studies. On the other hand, examining under-researched groups such as Sri Lankan Buddhists provided valuable insights into their cultural beliefs and practices. This led to a deeper comprehension of the meaning and value of souvenirs within this cultural framework, thus amplifying the overall richness of data.

The participant data was collected in native Sri Lankan language: Sinhala and transcribed to English for the analysis which may influence the qualitative findings. Therefore, it is important to consider precise translating and high-quality transcribing methods for future research.

Prototype design was limited due to high cost of design plugins and subscriptions related to 3D and AR technologies. The complexity of the prototype had to be narrowed down into extensively feasible designs due to this high cost. Therefore, future research must concern acquiring a research budget.

Obtaining informed consent from research participants is crucial as they must fully understand the study's purpose, potential risks, and benefits before voluntarily agreeing to participate [31]. Proper measures must be implemented to protect and secure the collected data for research and when designing for memorabilia, ensuring confidentiality and data integrity in compliance with GDPR [9].

Migration experience discussions can be emotionally challenging, so research procedures must minimize the risk of re-traumatization [21,48]. The triggering of memories raised ethical concerns such as memory overload of users so further research is required to learn what is healthy for users' mental health when balancing remembrance and forgetfulness.

Researchers should also show cultural sensitivity and respect for participants' beliefs and practices to avoid any misrepresentation or exploitation of their culture [8,33].

6 CONCLUSION & FUTURE WORK

The research shed light to preservation of souvenirs among first generation Sri Lankan migrants as an initial study of domain. This study contributed knowledge by introducing below themes.

- The selection of souvenirs for preservation depends on the associated symbolic values.
- Souvenirs can act as memory tokens by encapsulating symbolic value and associated memories when preserving.
- Augmented reality is a meaningful method of transferring souvenirs across diverse geographical contexts.

"Memory Box" prototype test results supported generated themes from interviews by providing empirical data. All participants chose to keep *Memory Stories* function from prototype and appreciated triggering memories which promote potential future research related to memory triggering and the balance of remembrance and forgetfulness when designing for memorabilia preservation.

Privacy and protection of souvenirs is a central theme in the research which opens new opportunities for holistic service designs since all participants preferred physical protection for their souvenirs providing legal protection. This can be seen as a novel concept that will inspire further research arising innovative business ideas in the industry.

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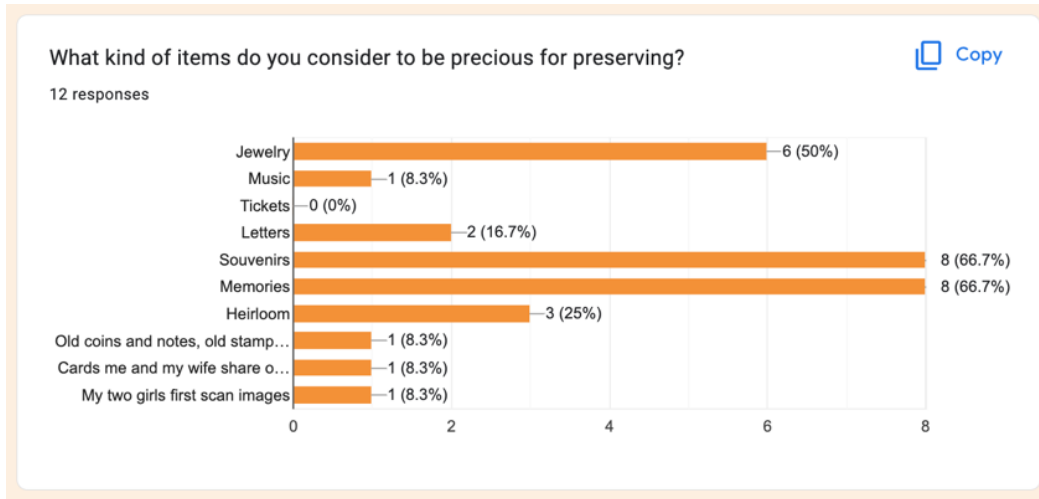
8 APPENDICES

8.1 Appendix 1

- All Assets: Consent forms, Interview Questions/Data, Workshop material, SWOT, Prototype, Testing etc

<https://drive.google.com/drive/folders/1BUSD5Rcvapopvmxel-MCXtFdztSoUH4d?usp=sharing>

8.1.1 Pilot Study Results



8.1.2 Interview Questions & Data Analysis

- Interview Questions:
https://docs.google.com/document/d/1W3AuyGKbHoOfLvxX0IJLx7dbR3qUJN0uE5oUl_QyYrM/edit?usp=sharing
- Thematic Code Map:
https://drive.google.com/file/d/1DA09Wdme8IY_Mq_e-vdh9QpUNrVkvG1/view?usp=sharing
- Thematic Code Matrix:
https://drive.google.com/file/d/19N_uhlZC1SviYFd4eNYXb7hD7pKQ7GGf/view?usp=sharing

8.1.3 Workshop Assets

- https://drive.google.com/drive/folders/1otmlPNnC5zpV0BMG9-G7LfDLdkg4gS3H?usp=share_link

8.1.4 Workshop Agenda – 90 minutes

<https://docs.google.com/document/d/1BEyCX5zRKoGGBZglapxArcRfwkB0C7Xiwl4uGS-XdGI/edit?usp=sharing>

8.1.5 Workshop Findings – Individual Brainstorming

Preserving for Future	<ul style="list-style-type: none"> • Preserving as printable digital 3D models. • Emphasis on preserving physical forms, traces, and originality. • Storing digitally and physically. • Preserving and storing as a service provider.
Sentimental Value	<ul style="list-style-type: none"> • Attaching multimedia related to the souvenir. • Upcycle while maintaining the sentimental value. • Capturing and storing the moments / Journaling. • Personalize organization (personal museum).
Forgotten things and frustration of losing	<ul style="list-style-type: none"> • Carry a replicate and protect the original object. • Keep a replicate to trigger memory. • Store safely. • Reducing size to make it transportable.
Protection and physicality of objects	<ul style="list-style-type: none"> • Maintain physical forms. • Physical safety leads to emotional satisfaction. • Miniaturize objects/ Upcycle. • Access control. • Providing safety for storing and transport.
Memories of associated people, places	<ul style="list-style-type: none"> • Include reminders to trigger memories. • Sharing and not sharing. • Attach multimedia to trigger memories. • Digital footprints. • Narrative and Narration are important.
Preferred Technologies	<ul style="list-style-type: none"> • 3D scanning / 3D printing / Photogrammetry / Haptics. • Cloud to maintain data and accessibility. • Using Photogrammetry to maintain traces in 3D objects. • Using QR technology to personalize sharing. • RFID Security on objects - Authorization levels.

8.1.6 Workshop – Analysed usecases from workshop, SWOT analysis, Empathy maps, Personas

- Link to use case & SWOT analysis:
<https://drive.google.com/file/d/1GEe5lrQYFMXhvJti2FnwQfcEwqzGYWq8/view?usp=sharing>
- Empathy Maps and Personas:
<https://drive.google.com/file/d/1dpH00xnrMfRzquDCB8FRLL1No0gIMu9/view?usp=sharing>

8.1.7 Prototyping

- Link to prototype (Open in a mobile browser): <https://memorybox.animaapp.io/>
- Link to sample 3D interaction: <https://memorybox.animaapp.io/3d-model-view-gnome>
- Link to prototype related assets:
https://drive.google.com/drive/folders/1BMl0VzwSw21h0M6HUnFgHKLbmybItKlM?usp=share_link

8.1.8 Memory Stories User Interface

https://drive.google.com/drive/folders/1QyHrmoBgjIArZLOUK9AiXeRX7lNCmP1?usp=share_link

8.1.9 Digitalization of souvenir

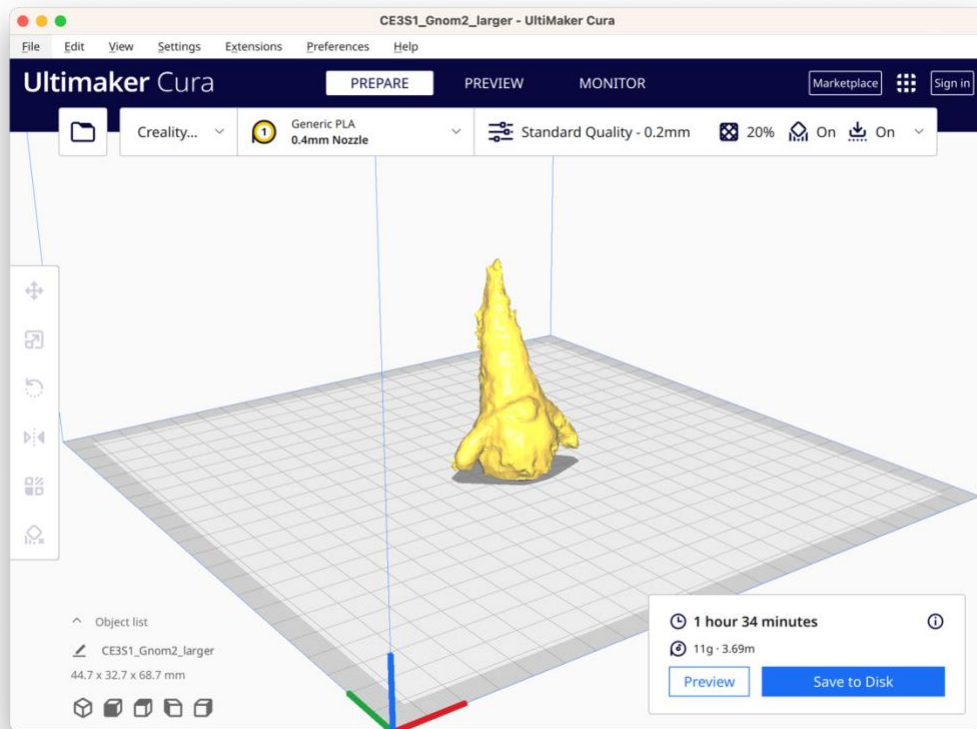


Figure 10. Print preparation of 3D model

- Links to 3D objects:
https://docs.google.com/document/d/13B0QlfxrLkGmA7bZxISaE1HU0nidVq_-j1rwfAK2H0c/edit?usp=sharing

8.1.10 Test Results and Analysing

- Link to assets:
https://drive.google.com/drive/folders/16rwB5_ogVxbVe8SsyySVElnOUZp86AdH?usp=share_link