

# Connecting Generations: Creating a Platform for Sharing Memories Between Elders and Youth

Anthøn Kristian Skov Petersen  
antpe20@student.sdu.dk

Emil Rimer  
emrim19@student.sdu.dk

Rasmus Ploug  
raplo20@student.sdu.dk

**Abstract**—This project explores and evaluates the development of an interactive photo album designed to engage both elderly and younger users, focusing on how visual and technical design can enhance motivation to use the application. The product consists of an application containing the digital photo album and a mobile application for managing and uploading pictures. New features have been added and existing ones redesigned to enhance the overall user experience. Both applications have been tested and evaluated through field studies. Relevant demographics were tested and interviewed. The findings offer insight on how elderly and younger users engage with the application, their opinion on the concept and what could motivate them to use the applications. The elderly saw little use for the application as other media already provided them with similar options. The younger audience showed a positive attitude towards the application and could see themselves using it at least on a weekly basis. While this project explored user engagement with the interactive photo album, there remains opportunities for further development.

**Keywords:** Interactive photo album, User experience, Usability testing, User engagement

## I. INTRODUCTION

An essential element of technology is its ability to provide a good user experience and to sustain user engagement. This project delves into the creation and evaluation of an interactive photo album designed to engage both elderly and younger users, focusing on how visual and technical elements can boost user motivation and engagement. The final prototype features a tablet application with a digital photo album and a phone application for managing and uploading pictures.

This paper extends a previous project named MeCo (Memory Connect), which examined the development of an interactive application intended to assist elderly people with Alzheimer’s Disease (AD) and dementia. The previous MeCo project can be found in the Appendix. This project also carries the name MeCo. Shifting focus from cognitive impairments, this project explores how diverse users interact with the tablet and mobile applications, uncovering methods to sustain their engagement. Various literature and methodologies have formed the creation of this prototype, supporting the procedures and design decisions made during development. Additionally, similar technologies and products have been analyzed to enhance the efficiency of this application.

Building on previous field studies, new features will be introduced and existing ones redesigned to enrich the overall user experience. These enhancements will be tested through tests and informal interviews. Testing will occur in a controlled

environment, while interviews will be conducted informally to gather qualitative data.

This paper will discuss the planned improvements and outline the methodology for upcoming evaluations. It will explore anticipated changes, analyze their expected impact on user engagement, and present projected results from tests and interviews. Additionally, the potential implications for future development will be examined.

## II. STATE OF THE ART

One of the big inspirations and competitors on the market is currently Apple’s Family Sharing<sup>1</sup> and Samsung’s new family settings<sup>2</sup>.

### A. Apple Family Sharing

Apple’s Family Sharing, launched in 2014, initially aimed to unite families through shared media. Over time, it expanded into a platform for sharing everything from music to personal data. Parents can easily manage their children’s devices, control screen time, and share calendars. It seamlessly integrates with iOS, nudging users to bring their entire family into the Apple ecosystem. Designed with Apple’s user-friendly ethos in mind, it’s intuitive for users of all ages. This application naturally also adheres to Apple’s design principles<sup>3</sup>. These user interface guidelines ensure continuity throughout the user experience, making sure the users are used to the button positions and styles. Apple is famous for its simple design and user-friendly interfaces. This also helps ensure that the application is user-friendly for both children and the elderly.

### B. Samsung Family

Samsung’s Family settings, introduced with the One 6.1 update in spring 2024, mirror Apple’s features but with a twist: internal family chat groups. Samsung positions this as a safe space for kids and elders to communicate, offering an alternative to mainstream social media. Like Apple, Samsung adheres to its own design principles, ensuring a comfortable user experience. As with Apple, Samsung has also used their own design guidelines<sup>4</sup> when creating this, thus also ensuring that the users are comfortable using the application.

<sup>1</sup>Read more here: <https://www.apple.com/family-sharing/>

<sup>2</sup>Read more here: <https://www.samsung.com/dk/one-ui/features/>

<sup>3</sup>Read more here: <https://developer.apple.com/design/human-interface-guidelines>

<sup>4</sup>Read more here: <https://developer.samsung.com/one-ui>



Fig. 1. Screenshots of Apples Family Sharing. On the right, an overview of a family group is shown with their corresponding age and role

### C. Facebook and Messenger

Facebook, currently owned by Meta Platforms, inc.<sup>5</sup> and launched in 2004, is a social media providing a service for social networking to users worldwide. According to the Danish Ministry of Culture <sup>6</sup> 77% of Danes had created a Facebook profile in 2019 and the platform has since then maintained its status as a big contender for social media. Communication between users is one of the main drivers for Facebook. This can be done in private chats or group pages. The group pages are for sharing posts, pictures and videos. When a Facebook user wants to engage with another user, they can create a private chat. This chat is only visible for the added users. Every shared item such as a message, photo or file is stored within the chat and can always be accessed unless it is directly deleted by the users. Saving pictures is however not necessarily meant to function as a photo album, but rather a system for sharing pictures relevant for the moment. Facebook also changes and decreases the quality of uploaded pictures and videos to enable it to load faster. Chats also allow for additional users to be added to the conversation. Facebook users can also create and manage shared group pages. These group pages can be both private and public and the individual capabilities of users can be controlled by admins. The Facebook group pages are ideal for sharing content with many people using posts with pictures, video etc. Here, users can also leave comments and engage with each other in the comment sections.

## III. THEORY - DEVELOPMENT PROCESS

This section describes the diverse methodologies employed in this project, equipping the team with essential tools for a more seamless and streamlined development process. The

<sup>5</sup>Read more here: <https://about.meta.com/>

<sup>6</sup>Read more here: [https://kum.dk/fileadmin/\\_mediernesudvikling/2020/Sociale\\_medier\\_-\\_brug\\_indhold\\_og\\_relationer.pdf](https://kum.dk/fileadmin/_mediernesudvikling/2020/Sociale_medier_-_brug_indhold_og_relationer.pdf)

methodologies derive from theories of software architecture, iterative design, and user-centered design, all aimed at reducing complexity, enhancing structure, and enabling teamwork.

### A. Scrum

Scrum [Schwaber, 1997], an agile framework for managing complex software projects, emphasizes incremental processes, flexibility, responsibility, and collaboration. Work is divided into fixed-length sprints, each encompassing planning, execution, review, and retrospection phases. Central to Scrum is the product backlog, a prioritized list of features, tasks, and bug fixes, managed in this project via Trello <sup>7</sup>. During each sprint's planning phase, tasks are assigned to team members from the sprint backlog and executed in the subsequent phase. The review phase showcases completed work, followed by retrospection to discuss potential improvements. This methodology excels in promoting accountability, adaptability, and continuous improvement by segmenting the project into manageable sprints, ensuring focus, prioritized feature implementation, and timely issue resolution.

### B. Iterative Development Process

A cornerstone of Scrum is the iterative development process, rooted in "The Agile Manifesto" [Beck et al., 2001]. This methodology breaks down the development lifecycle into smaller segments, offering a transparent project overview. Each iteration yields a functional product increment, enabling continuous improvement and adaptation through analysis, testing, and evaluation. The iterative process' strengths lie in its flexibility, transparency, early value delivery, and problem-solving capacity throughout development.

### C. User-Centered Design

The user-centered design (UCD) process, as popularized by Donald Norman's "The Design of Everyday Things," [Norman, 1988] emphasizes end-user involvement in design and development. UCD ensures end-user requirements are central, enabling effective user-centered customization. The process involves identifying end-users, specifying requirements, designing and developing an early product iteration, and conducting tests. Feedback from these tests informs further design improvements, ensuring the application meets user needs and avoids unnecessary features.

### D. Software Architecture

This project, building on a previous version, prioritizes enhancing the software architecture. Defined by Ken Bass, Paul Clements, and Rick Kazman in "Software Architecture in Practice," [Bass, 2012] software architecture outlines the application's structure and component interactions. Emphasizing the following quality attributes:

- **Usability:** The ability for users to navigate the application without confusion
- **Performance:** Making sure that the operations of the application function smoothly

<sup>7</sup>Read more here: <https://trello.com/>

- **Modifiability:** The ability to add, remove or alter system features after being initially developed.
- **Reliability:** Minimizing downtime and maximizing accessibility.
- **Engagement:** Keeping users motivated to use the application by implementing non-intrusive features that help engage the users

This methodology evaluates the system’s non-functional requirements. Additionally, a focus on code readability and documentation enhances the project’s clarity and comprehensibility.

#### IV. THEORY - CONCEPTS

##### A. Designing Mobile Apps

For digital design, there are many approaches to make an app visually pleasing. The approach used for this project has been to follow a design guide for not only visuals but also fundamental design rules for creating apps [Mujica et al., 2022]. This design guide covers the basics of creating a mobile application using theory and relevant case studies. In addition to using the design guide, inspiration has also been taken from examples of other existing apps and their designs. The purpose of looking at these examples has been to get an idea of what works well while comparing different design choices.

##### B. Visual Identity

One of the applied theories is the concept of visual identity [Mujica et al., 2022, p.119]. In the context of app development, a visual identity can be a communication tool and a system of opportunity to extend a company or product’s identity. Therefore, it is important to create a design that represents the brand without using it to an excessive degree. It is especially important to ensure an identity exposure that does not affect the navigation or the user experience.

##### C. Icons and Launch Image

The launch icon has the purpose of representing the app among all other apps in the App Store. The launch image is displayed when the app starts, and can be replaced by an illustration that is displayed when the app is launched. It helps welcome the user to the app using a sympathetic illustration. Interior icons are icons that communicate functions. The choice of interior icons should match the overall design of the app while showing the proper affordance of what each icon represents. Each icon must transmit the actions they perform, such as camera, albums etc.

##### D. Color and Proportions

Choosing a color scheme is fundamental to how an app is presented. the color scheme should match the purpose and branding of the application, while also being visually pleasing for the user. Choosing a color scheme can be done by using different color palettes to ensure that the colors are complementary to each other. It is important to have the correct proportions when designing an app. This includes having text and icons in a size that fits the application. The correct proportions are crucial for a good user experience.

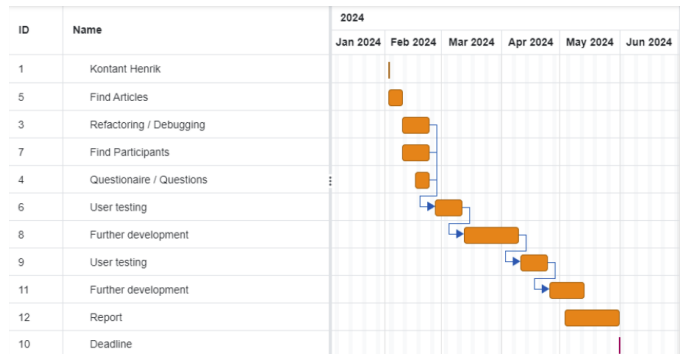


Fig. 2. Figure showcasing the Gantt-diagram made to set the timeframe of certain tasks within the project.

#### V. PROCESS DESCRIPTION OF DEVELOPMENT WORK

The following segment will showcase the process and thoughts behind the changes made from the previous version of MeCo. The first version of MeCo was not without flaws. Improvements suggested by experts and users were taken into consideration for the next phase of the project. This phase was split into two parts: first focusing on the tablet version, and then the phone version.

To start off, a clear list of objectives was created in Trello. The objectives were partly brainstormed, but also drawn from the previous project’s conclusions. These objectives were sorted into categories such as “Need to have” and “Nice to have”. The project was then split into different sections utilizing a Gantt diagram. This diagram can be seen on Fig 2, ensuring that each part was done on time to prevent falling behind.

The main focus of the first part of the project was the tablet version. The new user interface of the tablet needed to support newly implemented features such as a toggle to switch between showcasing family and photo albums. Moreover, a new way of visualizing the memories also had to be considered. It was decided to create a whole new Unity project to accommodate the new structural changes for the application. By doing this, the old design had to be remade to look identical. However, different designs and layouts were experimented with during this period. A new, modern, and more advanced layout was initially tested, but this led to a confusing user interface.

The focus of the second part of the project was the phone version. This had to be redesigned to better fit in with modern phone applications. Moreover, various design principles had to be applied to ensure it adhered to the standards within this field. Additional features to support the new structural changes for the tablet also had to be accommodated for.

Throughout the project, Scrum was used to ensure a consistent workflow as well as ensuring an iterative design and development process. Each week, Thursdays and Fridays would be allocated to work on the project. Following the principles of Scrum, the first thing on Thursday’s agenda would be to list the previous sprint backlog, and make sure that everything

was in order. The following Friday, the backlog would be updated with new assignments for the following week. This process ensured that the team constantly was up to date with requirements and updates on the project.

## VI. USER TESTS

An important part of this project has been user testing. The purpose of user testing has been to test the application's technical and visual aspects as well as to gather insight to what motivates users for sustained engagement. One pilot test and two main tests have been conducted. Two demographics have been tested. The first elderly above the age of 65 and the second being young people below the age of 18. According to the Danish Ministry of Social Affairs, Housing and Senior Citizens<sup>8</sup> people above the age of 65 years are qualified as being in the elder category. Above 65 years is therefore relevant for defining the elder category. The reason for choosing the younger category as under 18 years is to simulate a use case of younger grand kids uploading photos to their grandparents. The age gap provides a good foundation for testing the dynamic between two very distant age groups. It is also relevant to test if a younger audience can navigate the mobile application.

Both testing phases have been conducted in an informal environment with the purpose of gathering qualitative data. The quick and dirty methodology has been applied; this method supports and informal discussion using a prototype [Lewis, 2012]. The evaluation technique applied is a combination of asking users their opinion and testing user performance via a field study. The tests on the two demographic groups are not completely identical. The reason for this is that many aspects can vary, and each group can have different requirements that need to be considered. An example is the younger audience being able to move around the test environment, while the elderly might want to remain seated while testing.

### A. Pilot testing

As preparation for testing on elderly participants, a pilot test was conducted using the principle of *empathy through the imagined other* [Wright and McCarthy, 2008]. This principle supports the idea that an empathic methodology of simulating a physical or cognitive issue through an experience prototype can help the understanding of the participants. The pilot test consisted of testing the tablet application while younger participants below the age group of 65 would be influenced by a simulation of different characteristics. Details on the characteristics can be seen explained below. A picture of the test environment can be seen on Fig 3.

- **Hearing impairment:** Participants must wear a sound isolating headset.
- **Visual impairment:** Participants must either remove or add glasses.
- **Hand motoric impairment:** Participants must wear gloves.

<sup>8</sup>Read more here: <https://www.sm.dk/arbejdsomraader/aeldreomraadet>



Fig. 3. Image showcasing the testing of the tablet version with simulated impairments.

- **Cognitive distraction impairment:** Participants will be distracted by the facilitator while using the application.

### B. Designing a Test for Elderly Users over the Age of 65

The test of the elderly users was designed as a group based interview. The participants were a group doing an iPad course at a local community center. 8 adults over the age of 65 participated. The participants had been informed of the test prior and knew what to expect and had also been informed that the testing would consist of a presentation and then an open discussion. As preparation for testing the elderly group of users, empathic design was included. When preparing a usability test for older adults, it is important to keep in mind physical and cognitive related issues [Silva and Nunes, 2010]. Test facilitators should know and follow certain rules before conducting the test. The test environment for the elderly users was therefore designed to fit certain criteria based on these rules. These criteria included the concept of Care, Communication and Listening (CCL). These applied rules are:

- 1) Make it clear that *they* are not being tested.
- 2) Respect the opinions of the test participants.
- 3) Listen to the participant's historical narrative.
- 4) Use simple language.
- 5) Adjust your volume appropriately and repeat and paraphrase, if necessary.
- 6) Give test participants time to think.
- 7) Do not use elderspeak.

A picture of the visit to the community center can be seen on Fig 4. The picture was taken shortly after the interview was conducted.

### C. Designing a Test for Younger Users

The test for the younger users was conducted on a 8th grade at a Danish school. The participants were in the age group 14–15 years and would be tested in groups of 4-6 and they would start the tests by creating a profile in the mobile



Fig. 4. This image is taken shortly after the interview was conducted. In the picture is the group of elderly upon which the tablet application was introduced and tested.



Fig. 5. This image is showcasing the informal group interview post-testing. This was done at Odense Friskole.

application. Afterwards, they would be sent out within the local area where they would take a picture and upload it. The participants were given the use case of being the grandchild to an imaginary grandparent. Then, the group would be asked questions with the purpose of creating an informal group discussion. Afterwards the participants were shown the tablet application so they could see how their pictures had been uploaded. A picture of the test can be seen on Fig 5.

#### D. Questions for Qualitative Data

It was decided to ask a few questions with the purpose of starting a group conversation on different but relevant topics. All questions have been phrased so that they are objectively asked and do not provoke bias by using weighted phrasing. The questions for both groups were:

- 1) Would a technology like this be relevant for you?

- 2) What is your opinion on the concept?
- 3) Do you use any similar technologies already?
- 4) How often do you share photos with your family?
- 5) How do you normally share or organize photos?
- 6) What is your opinion on the functionalities?
- 7) What is your opinion on the design?
- 8) Do you feel safe uploading pictures to social media?
- 9) Did anything not work or confuse you?
- 10) What would motivate you to use the application?
- 11) Other comments?

#### E. Results from the Pilot Test

The pilot test study proved that the user experience for the tablet application is influenced by cognitive and physical impairments. No functions were unusable under the test conditions, but the overall quality of the experience fell drastically when using the app under different circumstances. The hearing and physical impairment proved least influential. The loss of hearing was mitigated by available screen text and the hand motoric disadvantage was mitigated by the simplicity of the app interface. Vision impairment and cognitive distraction affected the user experience to a higher degree. The vision impairment made navigation difficult while the cognitive distraction made the general use of the application difficult due to a lack of focus. However, none of the impairment conditions made the application unusable. This allowed for testing on the audience above the age of 65 without fundamental complications.

#### F. Results from Participants under the Age of 18

The test on the younger users showed that they had few to no issues with creating a profile and navigating the app. One participant could not create a profile and others had difficulties with loading times. Most participants could see the appeal of using the app and they found the concept relevant. However, few commented on other platforms with the same functionality such as Messenger or SMS. Only a few participants would send their grandparents photos, and those who did send photos did so infrequently.

All participants appreciated the design. One participant commented on the simplicity of the tablet app and that it could be perceived as “too simple or empty”. All participants felt generally safe when uploading pictures to social media, but with a clear preference of pictures being private and not publicly shared.

When asked what could motivate them to use the application, most of the participants responded with reminders or notifications as they could see themselves forget to use the app. There was also a consensus that it would be motivating if the grandparent could also write a comment on the photo. In addition, participants agreed that being able to view pictures from other uploaders would be motivating.

#### G. Results from Participants over the Age of 65

The test results for the elderly users showed that only a few participants agreed that this technology would be relevant for

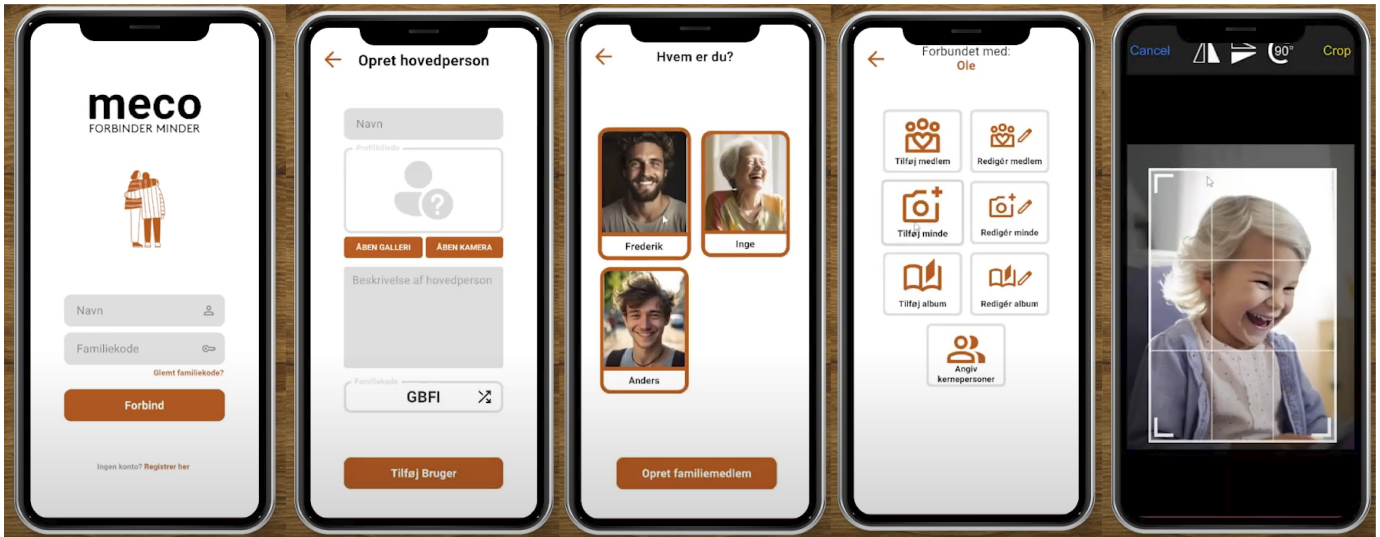


Fig. 6. Screenshots from the phone application. From left to right; Homescreen, Creating a user, Picking profile, Main Menu, Cropping images

them, as they preferred physical photo albums. Most of them were proficient with Facebook and Messenger, and many of them used the latter for sharing pictures with the family. Most would share photos on social media in Messenger chats that their relatives have created for the family. Others would use family sharing on their device to do the same. None of the participants felt unsafe when sharing photos on social media. Most of the participants did appreciate the design of the tablet app and found it easy to navigate. All participants were able to navigate the functionalities of the app. The consensus was that the app and concept was smart, but they already had existing technologies that they felt safe using.

However, when the participants were informed of the original use of the application in the context of Alzheimer and dementia, they all agreed that it could be extremely relevant when applied in nursing homes. All participants were positive that the app would be beneficial for both cognitive and social health for people at nursing homes who experience cognitive impairments.

## VII. DOCUMENTATION OF FINAL TECHNICAL PRODUCT

The final technical prototype is the result of a rigorous design and development process, representing an expansion and refinement of the previous project. It retains many core features from the previous application while integrating new advanced functionalities to enhance existing aspects. Consequently, the primary functions remain consistent with the initial version. The final prototype comprises a tablet application, a phone application, and a backend MongoDB<sup>9</sup> database. A video showcasing the application can be found in the Appendix.

### A. Phone Application

The family-side phone application acts as the control center for managing and uploading content for the elderly user. It

shows a modern and engaging design, facilitating smoother task execution for family members without frustration. Upon launching the application, users encounter the login screen where they can enter or create the family account linked to the elderly user. This family account encapsulates the elderly user, allowing all attached users to upload content to the tablet-side application. Creating an elderly user involves uploading a photo, providing a name, and adding a description. The phone application is showcased on Fig 6. Upon successful login, users can create their own profiles within the account, providing information such as a profile picture, name, description, and relation to the elderly user. Once established within the account, users can upload new content or edit existing family members, memories, and photo albums. Creating new family members follows a similar process to creating a new account. Similarly, creating a new memory entails uploading a photo, adding a description, and tagging relevant individuals present in the picture. Additionally, the user is automatically assigned as the memory's creator. Photo albums serve as organizational tools for sorting memories within the family account. Users can create albums for different events, holidays, or periods, facilitating easier navigation for the elderly user. The ability to edit content from the phone application ensures content relevance, while also providing an option to delete content if necessary.

### B. Tablet Application

The tablet-side application serves as the interface for the elderly user to navigate and interact with content uploaded from the phone application. It prioritizes simplicity and ease of use, catering to elderly users with limited technical skills. The tablet application is showcased on Fig 7. Upon opening the application, the elderly user is presented with a main menu screen offering options to view family members or photo albums.

<sup>9</sup>Read more here: <https://www.mongodb.com/>



Fig. 7. Screenshots from the tablet application. Top left: Homescreen on family toggle, top right: Homescreen on album toggle, bottom left: Showcasing the album "Maldiveerne", bottom right: Showcasing a specific picture from Inge

Selecting the former option displays profiles of all family members created. Clicking on a profile reveals details about the family member, along with memories associated with them. Clicking on a memory enlarges the image and displays its description.

Opting for the latter option allows the elderly user to browse through different photo albums, each containing categorized memories. Clicking on an album reveals its description and showcases contained memories.

A back button, located in the top left corner of the screen, provides constant access to the main menu. Additionally, the application features text-to-voice AI integration, enabling descriptions to be read aloud, particularly beneficial for elderly users with reduced vision or reading capabilities.

### C. MongoDB Database

The MongoDB database serves as the backbone of the project, facilitating smooth data flow between the phone and tablet applications. It is a NoSQL database management program, allowing data to be structured in the form of BSON-document objects. This database synchronizes, stores, and retrieves data between the two applications, enabling family members to create, update, and delete data remotely. Data is divided into distinct collections, optimizing storage and

retrieval. Images and audio clips are compressed into compact byte-arrays within their respective collections, ensuring efficient data processing. A UML diagram has been created to visualize the application's individual components and functions, see Fig 8.

### D. Changes from the Previous Version

The current iteration of the application builds upon the foundation of the preceding project, incorporating numerous significant features and enhancements to elevate user experience, functionality, and performance.

1) *Modern Look and Feel:* A prominent update in this version is the modernized aesthetic for both phone and tablet interfaces. Redesigned with a clean and minimalist approach, the user interfaces now offer a more engaging and intuitive experience. The tablet application, in particular, showcases multiple images simultaneously when accessing a family member or photo album, providing a superior overview compared to the old version. The pop-up window from the previous version has been merged with the gallery interface, resulting in a more cohesive design, while the color scheme remains unchanged.

The phone application has undergone a comprehensive redesign, emphasizing clearer navigation and consistent content placement. With clearly labeled icons and buttons, navigating

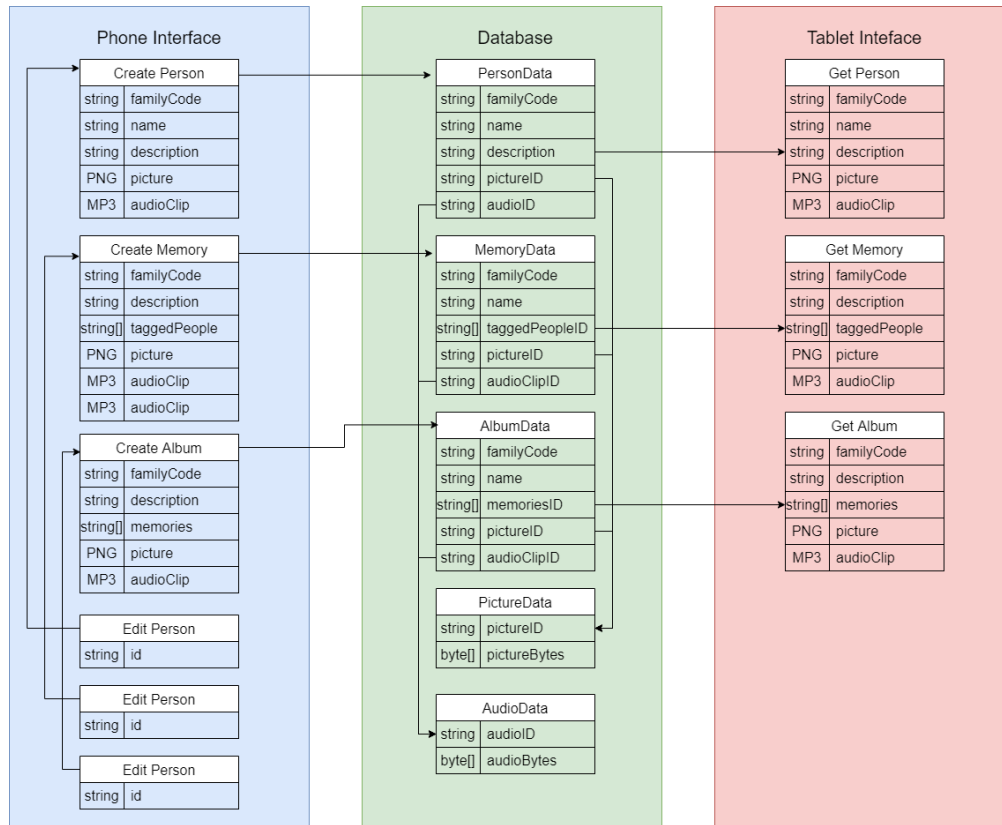


Fig. 8. An UML-diagram over the MeCo application.

the application is streamlined. Additionally, the color scheme contrasts well with text and icons for improved readability.

2) *Creation of Albums* : A noteworthy addition is the ability to create photo albums, allowing users to categorize and organize memories based on events, themes, or timelines. This feature offers a structured and intuitive method for recalling memories, especially for elderly users, enabling them to view memories not directly tied to individuals.

3) *Taking Pictures*: Users can now take pictures directly within the phone application, eliminating the need to close the app. This enhancement simplifies the process, creating a more seamless user experience.

4) *Cropping Pictures*: Users can edit and crop pictures directly within the application. An edit window allows for rotation and cropping, focusing on specific individuals or details. This feature, like the new photo-taking capability, removes the need to exit the application, further streamlining the process.

5) *Editing content*: Significant improvements have been made to content editing. Previously, modifying content required permanent deletion and recreation. In the current version, users can edit descriptions, names, choose new pictures, re-tag individuals, and reorganize photos within albums, providing flexibility and ease in updating content.

6) *Optimizing speed*: A critical enhancement is the optimization of speed. Previously, response times for data uploading and retrieval were significantly prolonged. Improve-

ments include the implementation of libraries for effective data compression and decompression, better organization of database collections, and the introduction of asynchronous loading. These changes reduce downtime and enable a more fluid user experience by allowing users to create new content while data is being processed in the background.

## VIII. DISCUSSION

### A. Pilot Study

Using the method of *empathy through the imagined other*, the pilot study revealed that none of the assessed impairments rendered the tablet application unusable. Understanding the target user is important and the pilot test result confirms theoretical expectations, offering insights into the significance of considering specific demographic characteristics during product development. The implication is that cognitive and physical characteristics may arise but are not inevitable. It can be beneficial to prepare for the actual test to ensure a comprehensive understanding of the target user. However, simulating this procedure poses certain limitations. In this pilot study, impairments might not have been accurately simulated, particularly the cognitive impairment, as replicating the experience of being easily distracted is challenging. Authentic simulation of impairment characteristics necessitates more data. These impairments were tested individually and it is plausible that multiple impairments could concurrently affect



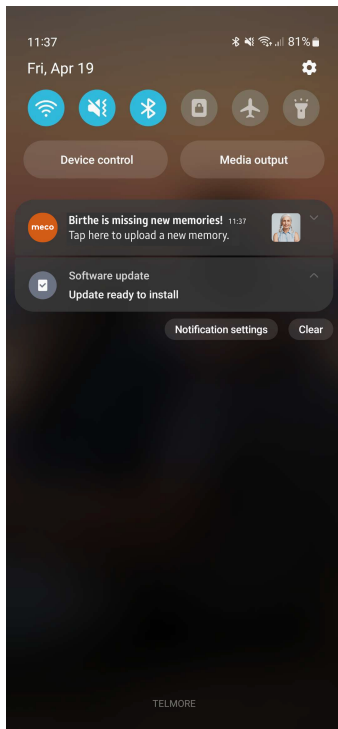


Fig. 9. Figure showcasing a mockup of a push-notification on an Android phone

the results. Testing various impairments simultaneously might be essential to ascertain their combined impact.

### B. Testing on Participants under the Age of 18

The group under 18 years favored the application's relevance and would use it if possible. Despite liking the concept, few had alternative technologies, and others admitted they would likely lose engagement over time unless additional features were added, such as notifications and chats like those on social media.

The results show these features align with those used by social media, highlighting theories of social media and internet addiction. While most participants agreed that a push-notification would remind them to use the app, it should not be exploited. A mockup of potential push-notifications can be seen on Fig 9 & 10. To sustain users over time, participants suggested providing reasons for logging in, such as news updates, to prevent stagnation. A chat feature was also recommended, supporting the theory of social translucence, though its long-term effectiveness might be sub optimal. Researching its motivational impact in the context of MeCo could yield different results compared to the case study.

Implementing these features would benefit motivation, but their ethical use and effects should be considered in future work. Designing addictive properties to avoid harming the user's relationship with the app over prolonged use is crucial.

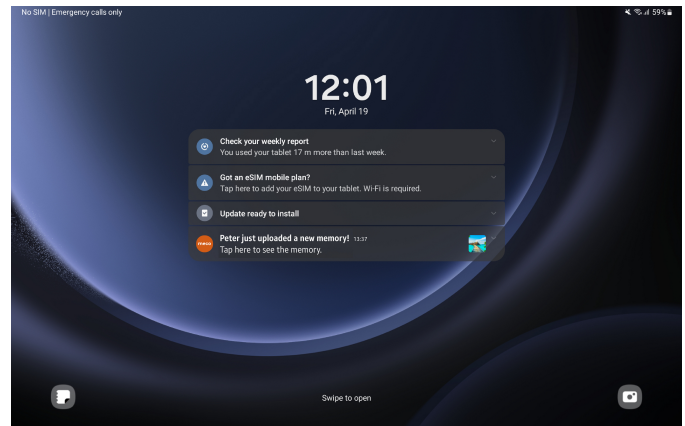


Fig. 10. Figure showcasing a mockup of a push-notification on an Android tablet

### C. Testing on Participants over the Age of 65

The testing of users above the age of 65 revealed that they were not the appropriate target audience for MeCo. This assessment involved a discussion about the irrelevance of MeCo for the participants, alongside reflections on potential areas of relevance for the technology. Prior to the test, theoretical principles were applied to enhance the design and structure of the test layout. The guidelines of CCL were proven advantageous for designing the test.

Before the test, the iPad course facilitator received a brief presentation to ensure a shared understanding of the project and the participants' expectations. A qualitative group interview was conducted to align with the participants' preference for a format resembling their usual iPad sessions. Some participants expressed apprehension about being tested or lectured, but the facilitators reassured them that their input was valued and respected. Throughout the discussion, participants shared personal anecdotes and historical narratives, engaging in conversations despite occasional discourse. Respect for all comments was paramount, and facilitators avoided technical language to prevent confusion. They asked only relevant questions to introduce new topics or clarify specific points. This approach resulted in a rich and lengthy dialogue among facilitators and participants.

This project aimed to assess a broader user demographic, including those above the age of 65. The concept proved irrelevant to most participants, who preferred physical photo albums they created themselves. Others used Facebook and Messenger for photo sharing, mirroring MeCo's functionality, thus seeing no need for a new system. The participants, engaging in an iPad course, were already proficient with current technologies and did not require substitutes. None had cognitive or physical impairments and routinely used tablets and mobile phones without issues, negating the need for MeCo's accessibility features. All agreed that MeCo would be better suited for nursing homes, where physical and cognitive impairments are more common. The test highlighted that the demographic above the age of 65 includes individuals who do

not require the accessibility features MeCo offers, making the previously identified target audience more relevant for tablet users than the new demographic above the age of 65.

#### *D. The Methodological Approach*

Prior familiarity and experience with Scrum proved optimal for this project. Some specific changes to this framework have been made to fit the project team. For instance, by collectively assuming the role of the Scrum Master it ensured that the Scrum framework was well-implemented and understood within the small team. Additionally, allocating the role of the Product Owner to the end users makes their feedback from user tests the primary representative voice. These adjustments fostered a more cohesive group dynamic and ensured that user feedback remained at the forefront of the development process.

Nevertheless, despite its benefits, the Scrum framework also presented some challenges. Its reliance on weekly meetings created a constant demand for updates, which became challenging during periods when finding suitable subjects for user testing proved difficult. Although testing the application remained a priority from the project's beginning, complications hindered the ability to consistently find suitable candidates for testing, thus impacting the progress of the project. Consequently, during these unproductive weeks, progress stagnated, and the development process faced limitations. Despite the team's best efforts to maintain momentum, the inability to conduct user testing effectively hindered the ability to move forward with implementing crucial design and functionality improvements. This highlights the critical importance of having a reliable and consistent stream of test subjects for ensuring the project's continued advancements.

#### *E. The New Design*

The primary focus when it came to the redesign of the tablet and phone applications was based on enhancing the user experience. The prior version of MeCo almost exclusively focused on an intuitive tablet application design for elderly with cognitive impairments, but never investigated how users actually engaged with the technology.

With the project's shift towards broader accessibility, moving away from solely focusing on elderly individuals with Alzheimer's and dementia, new design concepts needed to be applied. Only the tablet application benefited from applied design theory in previous iterations. Removing the accessibility design for cognitive impaired individuals would have made it easier to remake the app, but it would also remove already validated aspects that benefit the elderly users. For this reason, theory concerning design guidelines for elderly and people with Alzheimer's disease are still relevant for the continued development of this product [Ghorbel et al., 2017], [Phiriapokanon, 2011].

The mobile application, however, had remained largely unchanged, lacking any substantial design improvements. As the phone app had been neglected, improving its design and appearance became a priority for this project. Given that both the tablet and phone applications are essential to the integrity

of the entire product, it became necessary to apply the new design to both platforms.

The visual design changes made on both the tablet and phone application are in large part based on the before mentioned design guidelines. Some of the major changes, such as icons, color palettes, and a focus on visual identity have been implemented with the primary purpose of making the application more visually engaging. The results from testing the phone application showcases how these design guidelines actually have had a positive impact on user engagement. However, some limitations also became apparent. While users appreciated the visual appeal of the application, they also remarked that it lacked excitement and failed to differentiate itself from similar products on the market. This feedback highlights the importance of injecting uniqueness and personality into the application in addition to only prioritizing aesthetics.

#### *F. Software Architecture*

The focus of software architecture has been a relatively unnoticeable part of the project. Nonetheless, it can be argued that it has resulted in a more streamlined development process. However, despite the benefits gained from focusing on software architecture, there were some challenges encountered during the project. One notable issue was the initial lack of clarity and consensus among team members regarding the architectural design decisions. Because development of the application was divided into a phone and tablet version, some major differences in the software architecture between the two was later noticed. This resulted in delays as it became hard to navigate through each system when compared to its counterpart. This challenge underscores the importance for robust communication and collaboration in order to achieve consensus and define the overarching software architecture.

#### *G. Reflection on Unity for App Development*

Unity is a game engine designed for creating various games and applications. It supports a range of media, including VR, AR, computers, and mobile devices. MeCo has been developed in Unity, yielding valuable insights and experiences worth discussing. Crucially, Unity proves suboptimal for applications like MeCo, both on tablets and mobile devices. While Unity offers a robust framework for code and UI development, and simplifies the addition of visual elements, it is more suited for high-fidelity prototyping than for fully developed applications.

Initially, Unity facilitated the rapid creation of a high-fidelity prototype for MeCo. However, as development progressed beyond this stage, complications arose. Performance issues surfaced, characterized by sluggishness and unreliable database uploads, with no clear solutions. Though Unity excels in creating visual applications with basic backend support, increased backend requirements degrade its performance to an unreliable level.

An alternative approach involves developing the application in React using JavaScript. The React framework would enable a web-based application with superior backend capabilities. Additionally, React supports more advanced concepts like

server structures and communication, enhancing MeCo’s functionality. The cross-platform development offered by React would also render MeCo more dynamic and accessible across various platforms beyond tablets and mobile devices.

## IX. CONCLUSION

The project has been developed through an extensive research and design process, resulting in a prototype that builds upon the previous application called MeCo. Where the previous project focused on aiding the elderly with Alzheimer’s and dementia in reconnecting with their memories, this new version instead emphasizes enhancing the user experience and maintaining user engagement. The final product is the result of a thorough design conceptualization, iterative development process and multiple user tests. The final prototype consists of a digital photo album designed for a tablet device, and a phone application created to manage and edit content for the tablet application. Furthermore, a MongoDB database ensures data synchronization.

The tests conducted to evaluate the usefulness of the tablet application has resulted in valuable insight when it comes to the potential target demographic. It was concluded that the age group above 65 was too unspecific, and further testing on people in a more relevant demographic is suggested.

Additionally, the implementation of different design guidelines to enhance the overall aesthetics and look of the phone application has proven effective when it comes to enhancing user engagement. The younger demographic appreciated the concept, but recognized that they might still lose engagement over time if not influenced by motivating factors.

The user tests confirmed the potential of the two applications in practice, while also highlighting some of the potential shortcomings for future improvement. Future development of the project would include additional user tests in order to accumulate constructive feedback for continuous refinement of the prototype.

## X. PERSPECTIVES

For future MeCo app development, current testing feedback will shape improvements. Before final release, there’s plenty of room for enhancements, particularly highlighted by testing across different demographics.

Multiple suggestions arose while testing with the elderly for the usability of the application. Users proposed adding notifications for new memories, possibly via small indicators on family member icons. Sorting options for galleries were also requested, including chronological and popularity-based sorting.

Another idea was to enable screencasting slideshows to big screens for group viewing and reminiscing. This could also be paired with ambience music, to further immerse the users.

Younger demographic testing identified technical bugs and usability issues, like difficulty accessing one’s own pictures and adding to albums when creating memories. Suggestions

included push notifications and a Snapchat<sup>10</sup>-like streak feature, however, this would be reliant on a server setup.

Furthermore, the feature to record own audio clips was also recommended to increase the personal impact of the application.

## ACKNOWLEDGEMENTS

A special thanks to Henrik Schønau Fog and SMILE Lab Medialogy for giving us the opportunity to test the mobile application by supplying the necessary android phones.

Thanks to Odense Friskole and Skibhuscentret for participating in the project.

## REFERENCES

- [Bass, 2012] Bass, L. (2012). *Software architecture in practice*. Pearson Education India.
- [Beck et al., 2001] Beck, K., Beedle, M., Van Bennekum, A., Cockburn, A., Cunningham, W., Fowler, M., Grenning, J., Highsmith, J., Hunt, A., Jeffries, R., et al. (2001). The agile manifesto.
- [Ghorbel et al., 2017] Ghorbel, F., Métais, E., Ellouze, N., Hamdi, F., and Gargouri, F. (2017). Towards accessibility guidelines of interaction and user interface design for alzheimer’s disease patients. In *Tenth International Conference on Advances in Computer-Human Interactions*.
- [Lewis, 2012] Lewis, J. R. (2012). Usability testing. *Handbook of human factors and ergonomics*, pages 1267–1312.
- [Mujica et al., 2022] Mujica, A. L., Crowell, C. R., Villano, M. A., and Uddin, K. M. (2022). Addiction by design: Some dimensions and challenges of excessive social media use. *Medical Research Archives*, 10(2).
- [Norman, 1988] Norman, D. (1988). Design of everyday things.
- [Phiriyapokanon, 2011] Phiriyapokanon, T. (2011). Is a big button interface enough for elderly users?: Towards user interface guidelines for elderly users.
- [Schwaber, 1997] Schwaber, K. (1997). Scrum development process. In *Business Object Design and Implementation: OOPSLA’95 Workshop Proceedings 16 October 1995, Austin, Texas*, pages 117–134. Springer.
- [Silva and Nunes, 2010] Silva, P. A. and Nunes, F. (2010). 3 x 7 usability testing guidelines for older adults.
- [Wright and McCarthy, 2008] Wright, P. and McCarthy, J. (2008). Empathy and experience in hci. In *Proceedings of the SIGCHI conference on human factors in computing systems*, pages 637–646.

<sup>10</sup>Read more here: <https://www.snapchat.com/>