



(RESEARCH ARTICLE)



Brain Engagement and Assistance Companion (BEACON): A Cognitive Support System for Elderly Individuals in Tupi, South Cotabato

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Abstract

The study presents an app called BEACON (Brain Engagement and Assistance Companion) that is a tool to help elderly people in Tupi, South Cotabato suffering from memory, related cognitive problems. To ease the senior citizens' management of their routines, the system gives tailored reminders, simple exercises, and safety, promoted notifications. Since it is a completely offline mode of operation, the app is a perfect solution for areas where the internet connection is weak or there is no internet at all. Using the device is made easy for the elderly through large buttons and voice commands that are in line with the sensory requirements of aged people, whereas the caregiver features give the opportunity to family members to change the settings and check the progress. The research focused solely on evaluating the application's usability. A System Usability Scale (SUS) assessment was conducted among 100 participants, 50 elderly users and 50 caregivers, and the results indicated a positive result: 65.3% of users found the system highly usable, 67.6% reported that the interface was intuitive and easy to navigate, and 66.2% stated that the app effectively supported their daily activities. Additionally, 63.4% highlighted the importance of BEACON's offline accessibility. These findings highlight BEACON's potential as an accessible and culturally appropriate cognitive assistance tool for rural elderly communities.

Keywords: Cognitive Support; Elderly Care; Memory Exercises; Offline Access; Caregiver Support; User-Centered Design; Assistive Technology; Personalized Reminders; Human-Computer Interaction.

1. Introduction

Human-Computer Interaction (HCI) is a cross-disciplinary field that revolves around the design and the use of computer technologies coupled with the interactions that people (users) have with computers. HCI strives to enhance users' interactions with computers by rendering the latter more accessible and helpful to the user's needs (Craig et al., 2025; Pushpakumar et al., 2023). The success of a system is what is eventually seen when it properly balances its performance and functionality (Tekade et al., 2022). To a certain extent, this equilibrium is very vital when it comes to the design of assistive technologies for those in need of care, for instance, the elderly who might have cognitive decline and/or mild cognitive impairment due to aging (Castilla et al., 2020). Where such people are concerned, getting a user-centered design approach that is based on thoroughly thought-out principles becomes the main thing so as to be certain that technological interventions do actually make the lives of the users easier and their independence higher rather than the situation where more complexities have been added (Engelsma et al., 2023). Take for example the creation of context-aware systems; it can do a lot to lessen the problems of older adults in situations such as meal preparation by offering them the kind of help that is both timely and personalized (Chan et al., 2025). The coming of this technology into the daily routine of a certain group of people is very important and that group includes those who suffer from dementia where the decline happens not only in the cognitive, behavioral, and functional abilities but also in the general well-being of the affected ones making it imperative to come up with innovative solutions that at least ease the burden on

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the caregivers (Ma et al., 2024). There is a growing interest in the use of the so-called assistive technologies, among them are smart home systems and e-ink tablets, which are seen as potential sources of support for people with dementia in leading independent lives and at the same time enhancing their quality of life, while also relieving their families and caregivers of some strains (Ma et al., 2024) (Tiersen et al., 2021) (König et al., 2021).

The HCI techniques cited are instrumental in the creation of BEACON, a system that assists elderly individuals in Tupi, South Cotabato, who are experiencing memory-related problems. Through the use of user-centered and participatory design approaches, BEACON intends to be a stimulating tool that not only recognizes but also supports the cognitive and instrumental activities of daily living of its users. It offers convenient memory aids and reminders that function even in the absence of an internet connection. This study is about the use of participatory design methods to communicate with seniors while making automated devices that support their health. The main point is to consider older adults as partners during the system development stage; thus, the end product is both efficient and user-friendly.

1.1. Research Problem

This research highlights the study of BEACON, a cognitive assistance app that helps elderly people in Tupi, South Cotabato, who have memory issues. Most elderly people may find it very hard to take control of their daily routines, like remembering to take their medicines, going to appointments or recalling personal information, and this could affect the freedom and safety of their lives. The problem with the already existing reminder and cognitive support tools is that they rarely offer personalization, context awareness, or offline functionality that a user living in a community with poor connectivity needs. BEACON solves these problems by offering memory exercises, giving personalized reminders timely manner, and having a system for sending an alarm in case of an emergency, and these services can be reached through a user-friendly interface where large buttons and voice commands are available. Moreover, the app has the features of the caregivers, thus enabling relatives to keep track of the progress and give support. Through the provision of effective supports and culturally appropriate design elements, the ultimate goal of BEACON is to make life easier, secure, and more independent for seniors and, at the same time, genuinely support their caregivers.

1.2. Research Questions and Objectives

- How did the elderly individuals with the use of BEACON's personalized memory exercises and reminders affect their daily independence and cognitive function in Tupi, South Cotabato?
- How effectively does BEACON's offline feature deliver uninterrupted support to elderly users in locations with weak internet connection?
- How does the simple-to-use BEACON interface, with features like voice commands and large buttons, help the elderly users and their caregivers in terms of usability and engagement?

1.3. Objectives

- To design a BEACON as a cognitive aid application specifically made to help with the memory and daily routine management of elderly people in Tupi, South Cotabato.
- To develop BEACON with the ability to work offline so that it can be used in places with weak or no internet connection.
- To design a simple, easy-to-use interface for the users that would also incorporate voice interaction and features for the support of the caregiver thus, facilitating the users' engagement and the system's usability.

1.4. Justification and Significance

The BEACON study is intended to assist senior citizens in Tupi, South Cotabato, to enhance their memory and daily living through personalized exercises and reminders. The majority of older adults in this area lack sufficient support due to bad internet connections and the absence of easily usable technology. BEACON is equipped to work offline and is very simple with features such as large buttons and voice commands to be not only easy for elderly users but also for their caregivers. By resolving these issues, BEACON can become a constant source of cognitive support and can empower users to be engaged and independent. This research also provides valuable insights into the development of supportive technology for minority communities with limited resources. Lastly, BEACON is committed to improving the lives of elderly people and their caregivers through the provision of a practical and culturally-sensitive tool for brain health and daily living.

2. Literature review

2.1. Cognitive Support Systems for Elderly Individuals: Enhancing Independence and Memory

An increasing number of elderly people all over the world brings along a rise in the prevalence of cognitive impairments, which in their turn emphasize the necessity of finding ways to keep, and even improve, the cognitive abilities of the elderly (Leung et al., 2022; Ziegler et al., 2022). As a matter of fact, the evolution of assistive technologies has been going very well lately; to be exact, it has been very helpful for the older adults suffering from dementia and alike (Asghar et al., 2020). These kinds of systems are of great use as they employ the help of voice assistants, smart home appliances, and mobile applications to deliver communication, cognitive activities, and, most importantly, independence, self-esteem, and a good life to older adults who may be otherwise socially isolated, or even lonely (Luengo-Polo et al., 2021) (Liu et al., 2023). This is all the more important as the majority of elders wish to continue their life in the home they are accustomed to and live independently for as long as possible, a wish that is usually hindered by the decline of mental and physical health, which inevitably comes with age (Chan et al., 2024). Besides, the demographic changes towards a global aging society call for the necessity of innovations to tackle the double rise in cases of elderly people suffering from the effects of aging both physically and mentally, and it is estimated that by 2050 this number of people over 65 years of age who will be affected by such impairments will account for 16.0% of the total population (Ghorbani et al., 2021). The demographic trend represents a call for the urgent need to come up with realistic and readily available ICT solutions for seniors with cognitive disorders (Astell et al., 2021). To illustrate, the research results indicate that on the one hand, participation in scholarly activities and, on the other hand, physical exercise can complement each other in brain aging and the loss of cognitive and memory functions (Hertzum et al., 2021).

2.2. Offline Functionality and Accessibility in Rural and Underserved Communities

The integration of technology into healthcare and support for daily living brings new challenges, for instance, in rural and deprived areas where lack of proper infrastructure can significantly limit access. The quick spread of mobile devices, especially smartphones, is a great way of providing cognitive support to older people who live far away and have no easy access to any kind of healthcare facilities (Recio-Rodriguez et al., 2019). Connectivity via the internet is still a big problem in many remote areas and deprived surroundings, elderly populations who may be the ones getting the most out of such interventions (Bruni et al., 2023). Therefore, older adults in any part of the world with or without online access should have equal opportunities to use such (offline mode) applications (Cha, 2024) (Chan et al., 2024). The offline features allow older adults to be involved in brain exercises and other everyday activities without having to depend on a stable internet connection and thus solving the problem of the digital gap among old people (Chan et al., 2024). This strategy not only solves the problems of access to technology but also gives people the power to make use of cognitive interventions in their resource-limited settings and hence maintain their freedom and get a better life quality (Wu et al., 2025). In addition, making applications that can be used offline is a way of ensuring that essential cognitive aids will still be there for use in a situation of a network outage or in areas where connections are always weak, thus making the tools more dependable and useful (Anderberg et al., 2019) (Leung et al., 2022). It is worth mentioning that, despite issues such as the complexity of systems, reliability, and cost, the rural populations are willing to use digital health technologies (Jongebloed et al., 2024).

2.3. User Interface Design for Elderly and Caregiver Support

The design of user interfaces targeted at elderly individuals must take into account their specific cognitive, sensory, and physical characteristics so that the interfaces are usable and accessible (Khamaj & Ali, 2024). This means that devices should use large fonts, colors with high contrast, and easy-to-understand navigation to compensate for the natural aging of the eyes and the decline of hand coordination skills (Li et al., 2020). The use of voice commands can, therefore, be an excellent solution for people who have limited dexterity and are not able to use the standard input methods (Muñiz-Terrera et al., 2019). Besides, the involvement of caregivers in the design process not only helps the interface address their needs but also gives them a sense of control and confidence in assisting the elderly (Kaliappan et al., 2024). There are a lot of research works that have the provision of usability testing results with the elderly as a base to make recommendations in the design of mobile applications (Ahmad et al., 2021; Gomez-Hernandez et al., 2023; Wickramathilaka et al., 2025). Knowing users' digital skills is of paramount importance when designing interactive systems for a broader user group that includes the elderly who are often less digitally literate and yet important digital technologies are still largely underutilized (Goodman-Deane et al., 2021). On the other hand, some devices targeting the elderly community are just "senior-friendly" versions of the already existing products meaning they usually come with lowered functionality (Knowles et al., 2021).

3. Methodology

3.1. Research Design

This research is aimed at understanding elderly users and their caregivers by means of descriptive quantitative research design. The study will focus primarily on the feature evaluation of the BEACON system like personalized memory exercises, reminders, working without the internet, and easy-to-use interface components such as voice commands and large buttons. These design features are the independent variables while the dependent variables are user engagement, satisfaction, cognitive support effectiveness, and usability. This method allows for a direct measurement of the extent to which BEACON is a valuable tool for seniors to be able to live their daily lives independently and keep their cognitive functioning.

3.2. Participants

The main users of the BEACON app are the old people of Tupi, South Cotabato, who will be the primary participants of the study, and their caregivers who will assist them in their daily routine. Around 100 elderly participants along with their caregivers who will be supporting them will be selected. Since the BEACON app is designed to be installed on the phone of the elderly user, the caregivers will be able to access and manage the app if they borrow the device of the elderly person when it is necessary. In this way, only one app is used per device, thus, the setting and the use are simplified for both parties. This sampling allows for the evaluation of the system's usability, engagement, and effectiveness from the perspective of the direct users and their support network.

3.3. Data Collection

Data will be collected through structured quantitative questionnaires with Likert scale items. The questions will mainly focus evaluating the users' perceived ease of use, engagement with personalized memory exercises and reminders, helpfulness of the offline capability, and satisfaction with interface features such as voice command and large buttons. In addition, caregivers will provide their comments on how helpful and easy it is to support the elderly users through the system. Data collection will be held at locations in the community that are easily accessible in Tupi, thus it will be convenient for the participants.

3.4. Data Analysis

Descriptive statistics like means, standard deviations, and frequency distributions will explain the levels of engagement, satisfaction, and perceived cognitive benefits of the users. A comparative analysis may be conducted between the elderly users and the caregivers to see the differences in the usability and the effectiveness of the system. These analyses will be instrumental in the design and implementation of BEACON by showing the potential areas for improvement as well as the strengths.

3.5. Ethical Considerations

The study will follow the highest ethical standards. Participation will be voluntary, and participants will be informed about the research goals, their rights, and the privacy of the data before giving their consent. The participants' identities will be protected by anonymity. The consent form will explicitly state that a participant can withdraw from the study at any time without any kind of disadvantage. The research will respect the cultural traditions of the Tupi people and will also be sensitive to elderly people and their caregivers.

4. Advanced HCL design

4.1. System Architecture

The BEACON system is designed to provide easy and effective cognitive support to senior citizens through individualized memory exercises and reminders, and also to be a device that caregivers can easily use. It has a system equipped with online and offline features to guarantee a smooth performance in different settings, including places with weak internet signals. The ultimate goal is to have a simple, reliable, and culturally suitable mobile application that can be of great assistance to the elderly in Tupi, South Cotabato in their daily routine.

The system comprises several major components that function together to render it user-friendly, adaptable, and reliable:

- *User Interface (Client Side):* This is the part of the application that users see and with which they interact on their handheld devices. The designs and the visuals are made user-friendly, easy to understand, and culturally relatable so that old people and their caregivers can effortlessly find their way through the application, use its features, and keep themselves engaged.
- *Memory and Reminder Engine:* This is the part of BEACON that talks with users, gives them memory exercises, and provides reminders that fit their individual needs. In addition, it can function offline as well as online, thus if there is a place with a weak or no signal, there will still be support.
- *Content Database:* This is where the application keeps all the materials for the exercises, the settings for the reminders, and the culturally based content that has been personalized for the community. The database is being updated regularly in order that the content remains fresh and suitable for the users.
- *User Management:* The component handling user's sign-up and profile management is the user management system. It recognizes both the elderly users and the caregivers, thus allowing a caregiver to take the elderly's phone, change the settings, manage the reminders, and if necessary, do everything from one single app, one device.
- *Offline Mode Manager:* This is the one that is responsible for the app's smooth performance when there is no Internet connection. The data that is being worked on is always in sync with the central system whenever there is a connection, so the users are always up to date.
- *Backend Database:* It is a place where data is stored and is well protected against unauthorized access. It keeps all the information about users, the application, and the settings in an organized and safe manner.

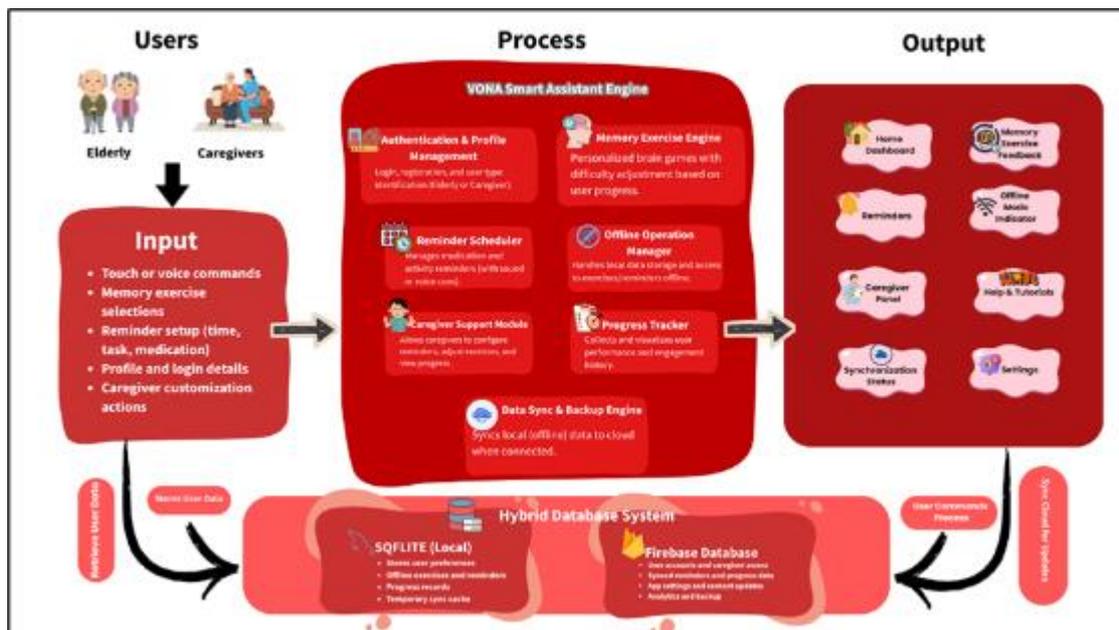


Figure 1 The diagram shows the BEACON System, a support system designed for the elderly users and their caregivers in Tupi, South Cotabato. The system comprises a user-friendly interface available on the device of the elderly person, a memory and reminder engine that delivers personalized cognitive support, and an offline mode manager to guarantee that the system is always operational without the need for internet access. User management is the feature through which caregivers can use the device to make the elderly familiar with it and assist them. At the same time, a secure backend database is the support for all components that not only synchronizes the data and protects the user information but also makes the system use safe and comfortable even in areas with low connectivity.

4.2. Features and Functionalities

The Features and functionalities of the BEACONS system are as follows:

- Personalized Memory Exercises and Reminders

BEACON, through personalized brain training games, motivates elderly users and at the same time, it provides them with reminder notifications in order that they can independently continue their accustomed daily routines and exercise their brains.

- Offline Accessibility

The system is completely functional without a connection to the internet; as a result, those users who are living in areas with weak or no network can carry out all activities without being interrupted in any way.

- Easy-to-use Interface

The app is full of features like big buttons, readable text, and voice commands that make the app very user-friendly for the elderly. At the same time, the caregivers are free to take the device for assistance in the setup and management, which is very convenient for them.

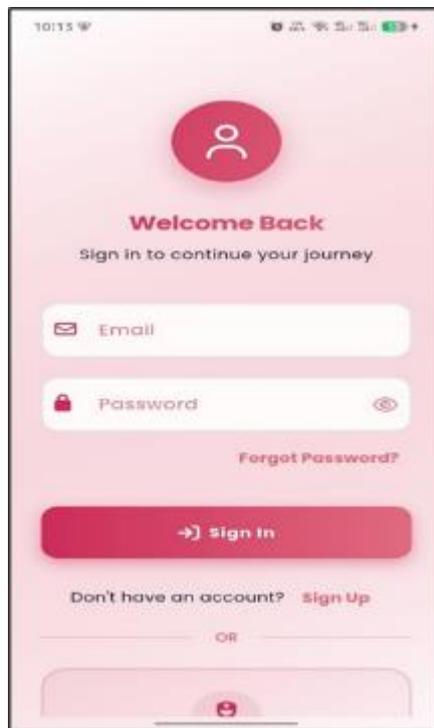
- Caregiver Support Features

If a caregiver takes an elderly person's phone, they can use special tools in the app to customize the exercises and reminders for the elderly. In this way, they can provide support more easily and if the need arises.

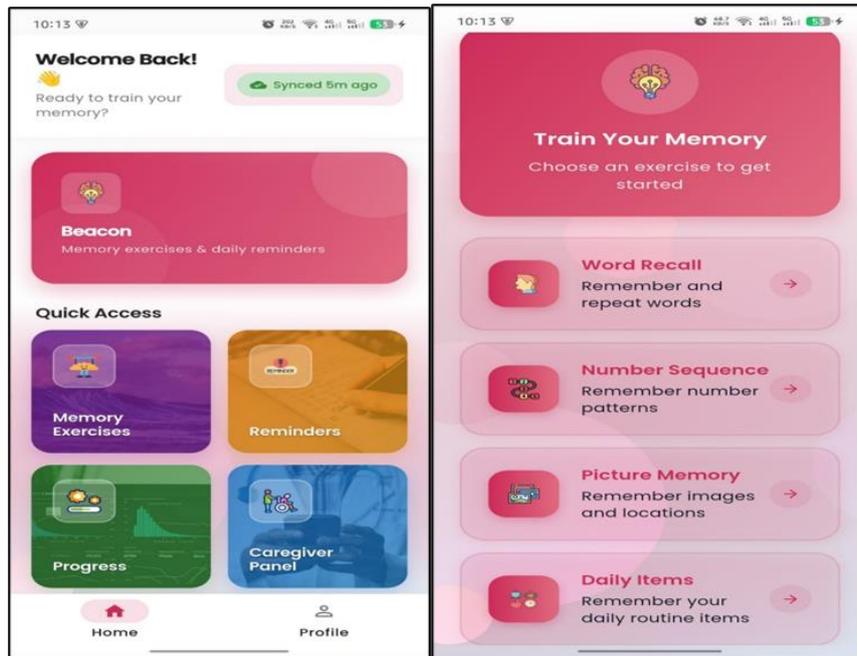
- Data Synchronization

BEACON is going to save documents, settings, and steps through the web regularly whenever it is connected to the network.

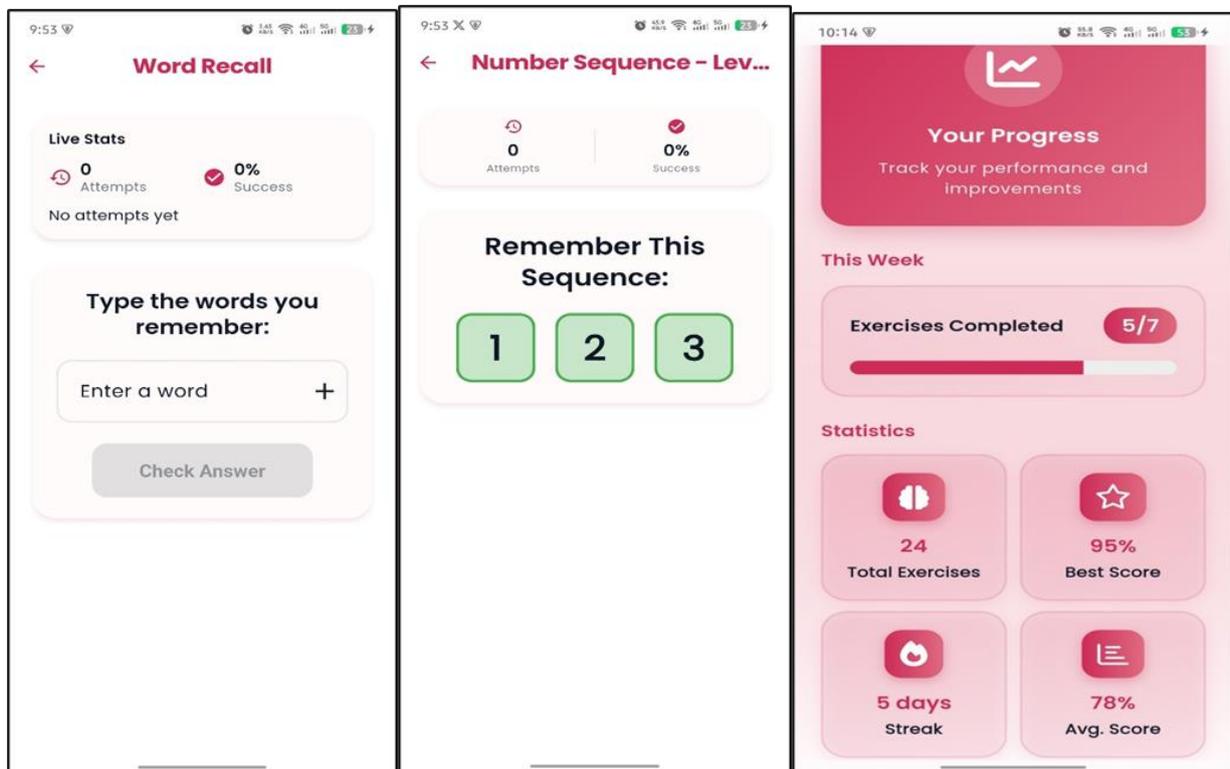
4.3. User Interface Design



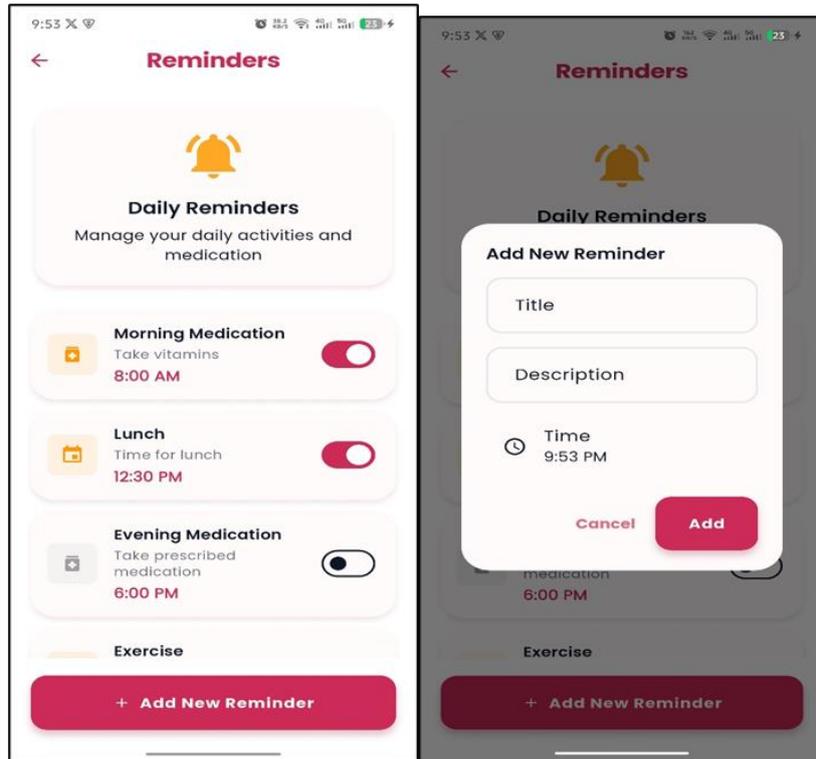
This figure illustrates Login and profile screen from which users provide their credentials or create new accounts, and caregivers utilizing the app on the elderly person's device get access.



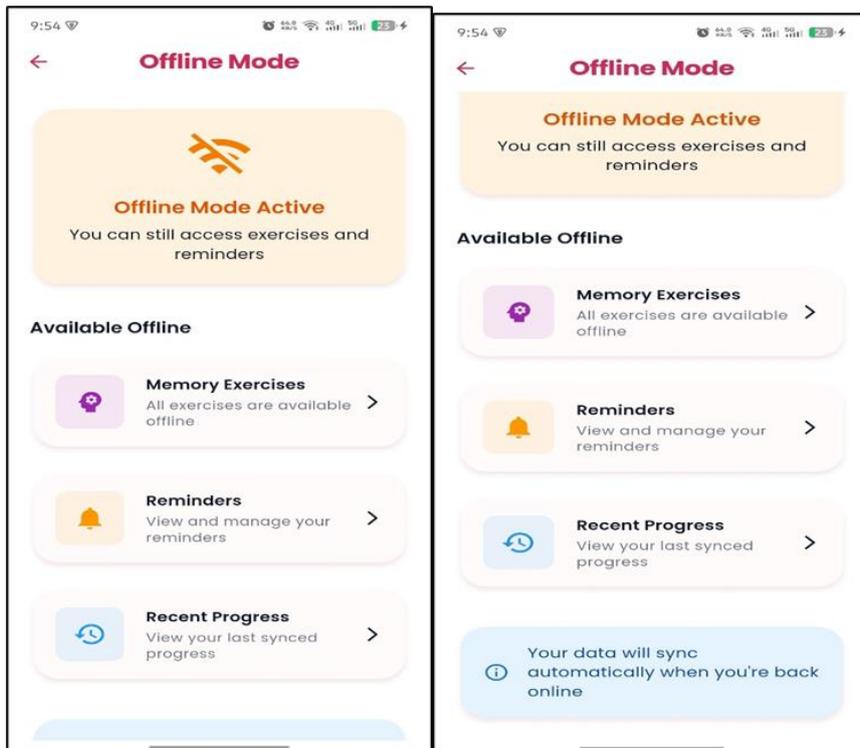
The figure illustrates the home screen from which aged users and their caregivers can navigate effortlessly through memory exercises, reminders, and caregiver tools.



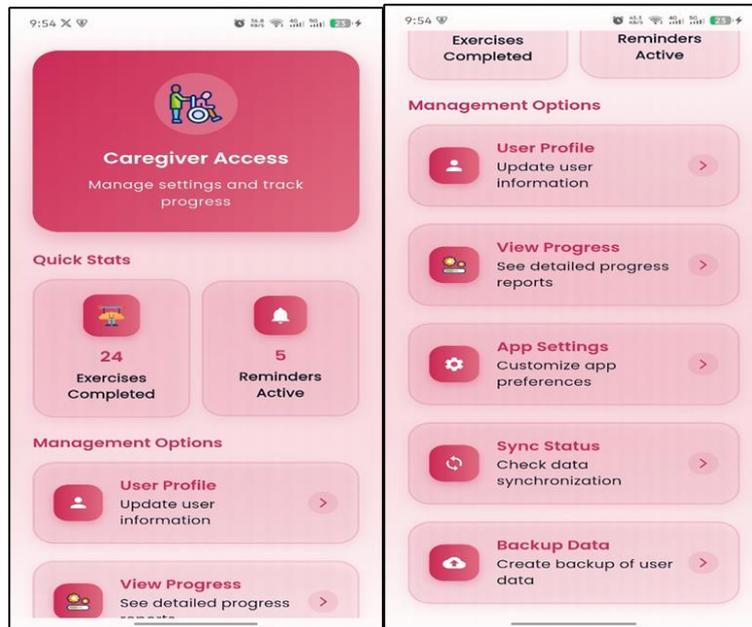
The figure illustrates the memory exercises screen presenting straightforward brain training activities with visually appealing characters and unambiguous steps.



The figure illustrates the reminder setup screen from which users or caregivers enable and operate reminders for daily activities and medication intake.



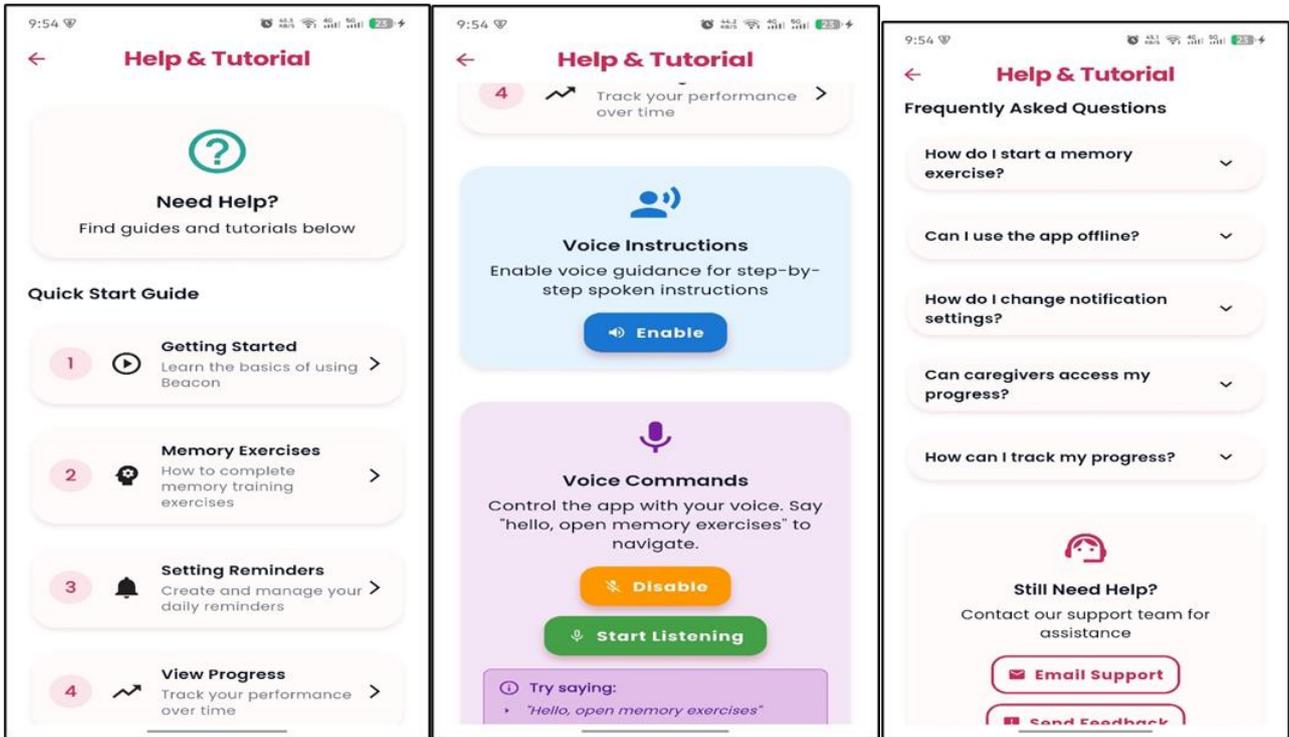
The figure illustrates the offline mode screen that facilitates continual access to the exercises and reminders for users without internet connection.



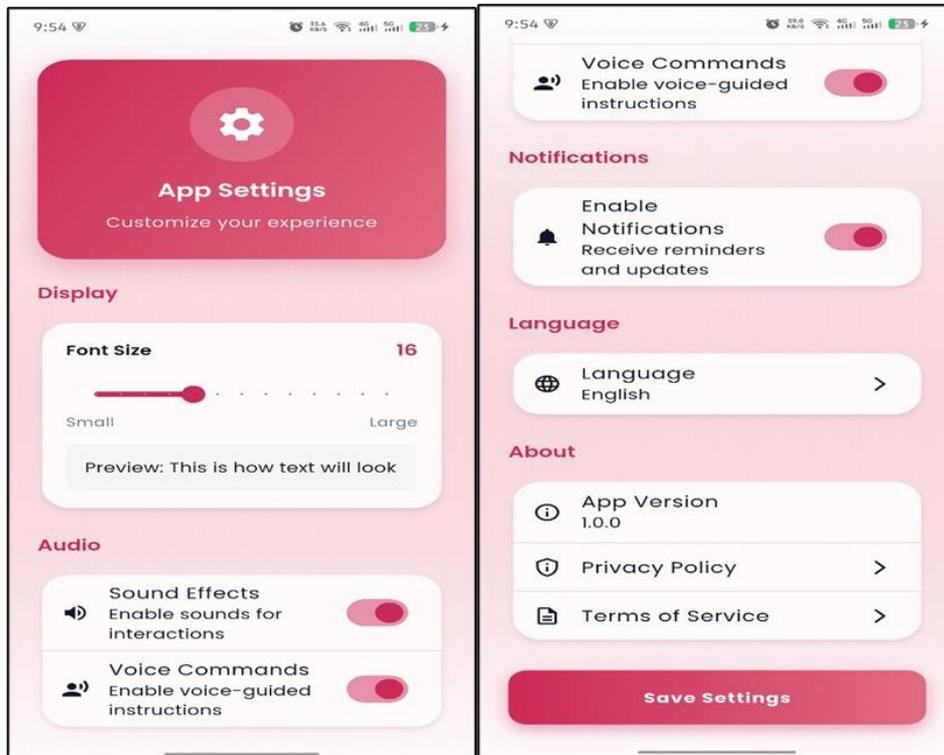
The figure illustrates the caregiver panel from which the elderly facility borrows the device to personalize settings and keep track of the progress.



The figure illustrates the progress screen bringing the performance of the senior user to the front, and at the same time, it is a platform where users as well as caregivers can leave their feedback.



The figure illustrates the help and tutorial screen that includes simple guides and voice instruction to support users in navigating the app.



The figure illustrates the settings screen from where users are able to change font size, sound, and voice commands as per their requirements.

5. Evaluation and results

5.1. Usability Testing

The usability testing of the BEACON system revealed positive feedback from both elderly users and their caregivers. Elderly participants, who interacted with the app’s memory exercises, reminders, and interface, rated the system highly in ease of navigation (Mean = 4.15) and expressed confidence in using the app (Mean = 4.10). Similarly, caregivers, who accessed the app by borrowing the elderly person’s device to set up reminders and monitor activities, also found the system easy to navigate (Mean = 4.00) and felt confident using it (Mean = 3.95) Both groups agreed that the app was straightforward to learn, with elderly users rating quick learnability at a mean of 4.00 and caregivers at 3.95. Participants generally disagreed that the app was confusing or cumbersome, indicating overall usability and a smooth user experience.

Table 5.1.1 Usability Result Table

Questions	Elderly Users Mean	Caregivers Mean
1. I found the system easy to navigate.	4.15	4.00
2. I found the app confusing to use.	2.30	2.45
3. I had to learn a lot before I could use it	2.90	3.00
4. Most people would learn to use this app quickly.	4.00	3.95
5. I thought I would need technical help to use it.	2.20	2.35
6. The app was cumbersome to use.	2.10	2.25
7. I felt confident using the app..	4.10	3.95
8. The app was inconsistent in its behavior.	2.40	2.50
9. I would like to use this app frequently.	4.10	3.90
10. Overall, I was satisfied using the app.	4.05	3.85
TOTAL MEAN	3.23	3.22

5.2. Performance Metrics

Performance metrics were implemented to measure how the changes brought about by BEACON influence users’ engagement, confidence, and satisfaction. There were two user groups. First, elderly users who directly use BEACON for cognitive support. Second, caregivers who, by borrowing the device of the elderly person, use the app to assist with the setup and reminders. Both groups gave a positive response, seeing the system as easy to use and helpful in their daily tasks. Memory exercises and reminders are methods through which elderly users reported to be highly engaged and confident. On the other hand, caregivers found it simple to manage the app on a shared device, which made the process of assisting them both easier and more efficient. The two groups agreed that the offline function of BEACON was crucial for them to be able to use it anytime and anywhere, especially in areas where there is poor internet connectivity. Some of the feedback pointed to the fact that providing clearer instructions and including help features could enhance not only the first-time onboarding process but also continuous usage. It would enable users and caregivers to understand the app’s full capabilities better.

Accessibility (Elderly Users): 3.27 (65.3%) – Elderly users seemed to perceive the BEACON app as a tool which is easy to use, as well as that it provides them assistance and in particular, they liked the fact that the icons, buttons, and the navigation are very clear. In their opinion, they were very comfortable while interacting with the app, which is reflected in the high scores for satisfaction. Nevertheless, a few users pointed out that it would be better if finding instructions and mastering all features were improved, thereby implying that there is a moderate level of need for additional help and more guidance.

Accessibility (Caregivers): 3.17 (63.4%)– Caregivers have also experienced the app positively in general and as a result were very satisfied. The app capabilities supported their offline tasks and it was easy to handle the device of the

elderly user. To make the process of setting up and daily use even more comfortable, they have also recommended getting the technical support ready and the availability of clear instructions from which one can easily understand.

Table 5.2.1 Accessibility Result Table

Questions	Elderly Users Mean	Caregivers Mean
1. The icons, buttons, and labels were clear and easy to understand.	4.20	4.00
2. I can easily navigate through the app's features without confusion.	4.10	3.90
3. The app works well offline and is accessible without an internet connection.	3.95	4.05
4. Instructions and help features are easy to find and follow.	3.30	2.95
5. The text size and buttons are too small, making it hard to use.	2.20	2.10
6. I had trouble finding instructions or help when I needed them.	2.35	2.40
7. The app often runs slowly or has technical problems.	2.25	2.30
8. Switching between different features and screens is difficult.	2.15	2.20
9. BEACON is accessible and usable regardless of my location or device.	4.05	3.80
10. Overall, I was satisfied with the accessibility of the app.	4.10	3.95
TOTAL MEAN	3.27	3.17

Functionality (Elderly Users): 3.38 (67.6%) — Elder users were very impressed with the main features of the BEACON app, especially the personalized memory exercises (Mean = 4.00) and reminders (Mean = 4.05), which helped them manage daily routines with increased confidence. They also positively rated the app's feature, smooth integration, and stable performance (Mean = 3.95). Scores around 3.20 for app responsiveness (Mean corresponding to question 3) and approximately 3.10 for technical smoothness (reflected in negative questions 6-8) indicate that there is a need for technical upgrades to improve the user experience.

Functionality (Caregivers): 3.31(66.2%) — The caregivers considered the app a good tool to perform their role in assisting elderly users. They were enthusiastic about the setup and monitoring tools (Mean = 3.85) and also the easy and understandable interface (Mean = 3.80). A few caregivers reported that the system was slow to respond at times (Mean = 2.95 for question 3) and that they were occasionally unable to manage multiple features (mean near 3.00 in question 8), thus pointing to the need for usability improvements and better user guidance.

Table 5.2.2 Functionality Result Table

Questions	Elderly Users Mean	Caregivers Mean
1. The memory exercises and reminder features operated efficiently.	4.00	3.85
2. It is easy to understand how the app functions.	3.20	3.80
3. The app was quick to respond to my inputs.	3.85	2.95
4. Using the cognitive support features, I felt I had control and confidence.	3.20	3.50
5. Different features (exercises, reminders, caregiver tools) are at the same level and work smoothly.	3.95	3.80
6. I encountered obstacles or complications while using some features.	2.90	2.85
7. The app often runs slowly or freezes.	2.80	2.75
8. I found some features confusing or hard to use.	3.10	3.00

9. I frequently needed technical help to use the app properly.	2.70	2.65
10. I found the overall experience of using the system enjoyable.	4.05	3.90
TOTAL MEAN	3.38	3.31

5.3. Comparative Analysis

The research compared the BEACON system with other cognitive support apps that are used for elderly care in underserved and rural communities. Elderly users and caregivers alike rated BEACON as a user-centered, culturally sensitive, and offline-accessible product that distinguished it from more general apps that are often dependent on internet connectivity and have complicated interfaces. Users of the app highlighted the convenience and simplicity of the BEACON design, stating that the personalized memory exercises and reminders made the management of daily routines not only easy but also fun. There are some existing tools which can be too complicated or may not be locally relevant, whereas BEACON manages to provide effective cognitive support while taking into account the culture and being easy to use. The minor issues such as occasional slow responses and the need for more detailed onboarding which were pointed out, however, they did not have a significant impact on the overall level of satisfaction. Participants believed that BEACON understood their cultural context better and was more suitable for their daily lives than other technologies that were available to them.

6. Results and Findings

The combined results of the usability, accessibility, and functionality assessments show that BEACON has been successful in achieving its objectives:

- Usability – 3.23
- Accessibility – 3.22
- Functionality – 3.35

The System Usability Scale (SUS) and user comments reveal that elderly users and caregivers are a group of people which can be described as confident, satisfied, and motivated to continue using the system. Users considered BEACON an effective tool and a simple one to operate, which has led to the facilitation of daily routine management and cognitive engagement of elderly participants. Caregivers emphasized that the incorporation of caregiver management tools in BEACON helped them to provide better support to the elderly, thus strengthening the communication and collaboration not only within families but also in care networks. The offline features made it possible for the assistance to be continuous even in those areas with low connectivity, which was a very important factor in the rural setting.

7. Discussion

7.1. Interpretation of Findings

The research examined the influence of the BEACON system on the elderly users' daily cognitive support, usability, and overall experience, as well as the caregivers' in Tupi, South Cotabato. Major aspects of BEACON, for example, tailored memory games, reminders, and the ability to work without internet, were identified by the results as the main factors that led to the users' involvement, were intuitive, and users were content with these features.

Table 7.1.1 Descriptive Survey Result Table

	Questions	Mean	Standard Deviation
1.	How effective are the memory exercises and reminders in supporting daily routines?	3.70	0.48
2.	How helpful is the offline accessibility in ensuring continuous use?	3.65	0.52
3.	How engaging do you find BEACON's user interface and caregiver features?	3.75	0.47
4.	To what extent does BEACON help increase your confidence in managing cognitive tasks?	3.70	0.50

5.	How satisfied are you with your overall experience using BEACON?	3.80	0.45
	TOTAL MEAN	3.72	0.48

RQ1: How does BEACON's personalized memory exercises and reminders affect elderly users' independence and engagement?

According to the users, memory exercises and reminders are the most significant tools that help elderly users manage their daily activities and maintain independence. The mean score of 3.70 indicates that users perceive these tools as effective and that their confidence is raised through them.

RQ2: What are the effects of offline functionality on usability and continuous support in areas with poor internet connectivity?

There was a positive average score of 3.65 for the offline mode, which is a reflection of the strong appreciation voiced by both elderly users and caregivers. This feature, which provides support at any time and any place, thus, overcomes the problem of access to the internet, which is still unreliable in rural communities.

RQ3: How do the user-friendly interface and caregiver support features influence user engagement and satisfaction?

The user-friendly simple large-button interface of BEACON along with the features for caregivers scored the highest in engagement and satisfaction (mean 3.75 and 3.80 respectively). Users stated that easy navigation and caregiver involvement were the reasons that they stayed motivated and engaged in cognitive activities.

7.2. Contributions and Innovation

This study underlines the importance of human-computer interaction (HCI) principles tailored for elderly populations and caregivers in remote communities. BEACON stands out by combining personalized cognitive support with an accessible offline design and caregiver participation, which many generic apps lack. The app's simplicity and cultural appropriateness make it practical and empowering for elderly users managing cognitive health. BEACON illustrates how thoughtful, inclusive design can enhance quality of life and care in underserved environments.

7.3. Limitations and Future Work

The research focused on elderly users and caregivers in Tupi, South Cotabato only, therefore, the results might not be applicable to different environments or populations. Subsequent researches may include different groups and also assess cognitive outcomes over a longer period as well as user retention. There are some possible ways to upgrade the BEACON such as adding more personalized exercises, introducing a caregiver training module, and creating more comprehensive onboarding materials. Additionally, a later version could consider the connection or coordination with the local health sector and other sources of support as a means to broaden the effects.

8. Conclusion

8.1. Summary of Key Findings

BEACON's usability, engagement, and satisfaction were all very well-liked by elderly users and caregivers alike. The system's ability to work offline, the personalized memory exercises, the reminders, and a straightforward interface were the main factors that made it effective in both supporting cognitive independence and in managing the daily routine. The involvement of the user-centered design and the caregivers were two of the most important elements that led to the app's acceptance and its positive influence.

8.2. Final Remarks

In conclusion, BEACON is a convenient, user-friendly, and culturally aware tool that supports the cognition of the elderly, which is personalized to the requirements of older people and their caregivers in places where there is poor or no network. The present study serves as a call for the implementation of participatory inclusive design principles in the area of health technologies, and it provides evidence of the ways in which carefully designed applications can bring substantial changes to the underserved communities. Further user engagement and hardware/software enhancements will keep BEACON as a source of strength and a tool for brain health among senior citizens.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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Appendices

Appendix A: System Usability Scale (SUS) Likert Scale Survey Questionnaire

Functionality

Questions	Ratings			
	1	2	3	4
1. The memory exercises and reminder features operated efficiently.	1	2	3	4
2. It is easy to understand how the app functions.	1	2	3	4
3. The app was quick to respond to my inputs.	1	2	3	4
4. Using the cognitive support features, I felt I had control and confidence.	1	2	3	4
5. Different features (exercises, reminders, caregiver tools) are at the same level and work smoothly.	1	2	3	4
6. I encountered obstacles or complications while using some features.	1	2	3	4
7. The app often runs slowly or freezes.	1	2	3	4
8. I found some features confusing or hard to use.	1	2	3	4
9. I frequently needed technical help to use the app properly.	1	2	3	4
10. I found the overall experience of using the system enjoyable.	1	2	3	4

Accuracy

Questions	Ratings			
	1	2	3	4
1. I found the system easy to navigate.	1	2	3	4
2. I found the app confusing to use.	1	2	3	4
3. I had to learn a lot before I could use it	1	2	3	4

4. Most people would learn to use this app quickly.	1	2	3	4
5. I thought I would need technical help to use it.	1	2	3	4
6. The app was cumbersome to use.	1	2	3	4
7. I felt confident using the app.	1	2	3	4
8. The app was inconsistent in its behavior.	1	2	3	4
9. I would like to use this app frequently.	1	2	3	4
10. Overall, I was satisfied using the app.	1	2	3	4

Accessibility

Questions	Ratings			
1. The icons, buttons, and labels were clear and easy to understand.	1	2	3	4
2. I can easily navigate through the app’s features without confusion.	1	2	3	4
3. The app works well offline and is accessible without an internet connection.	1	2	3	4
4. Instructions and help features are easy to find and follow.	1	2	3	4
5. The text size and buttons are too small, making it hard to use.	1	2	3	4
6. I had trouble finding instructions or help when I needed them.	1	2	3	4
7. The app often runs slowly or has technical problems.	1	2	3	4
8. Switching between different features and screens is difficult.	1	2	3	4
9. BEACON is accessible and usable regardless of my location or device.	1	2	3	4
10. Overall, I was satisfied with the accessibility of the app.	1	2	3	4

Appendix B: Descriptive Survey Questionnaire

Brain Engagement and Assistance Companion (BEACON): A Cognitive Support System for Elderly Individuals in Tupi, South Cotabato

- How effective are the memory exercises and reminders in supporting daily routines?

Not At All Slightly Very Much Extremely
- How helpful is the offline accessibility in ensuring continuous use?

Never Rarely Often Always
- How engaging do you find BEACON’s user interface and caregiver features?

Very Poor Poor Good Excellent
- To what extent does BEACON help increase your confidence in managing cognitive tasks?

Strongly Disagree Disagree Agree Strongly Agree
- How satisfied are you with your overall experience using BEACON?

Very Dissatisfied Dissatisfied Satisfied Very Satisfied