Are You Okay? Development of Electronic Check-In Systems for Isolated Older Adults

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Abstract. The COVID-19 pandemic has exacerbated an already prevailing issue of social isolation among older adults. The aging population is rapidly expanding, leading to an increasing numbers of older adults expressing feelings of social isolation. In this paper, we describe two low-cost physical check-in systems to help low-SES older adults check-in with their loved ones and peers. Both the check-in systems offer the same functionality, however one system is ready made and non-customizable, while the other system is a customizable version that offers more flexibility in design and can address ageism in technology design, help older adults. Such peer-based check-in systems can help older adults age-in-place, empower them to take care of one another, and help them maintain independence.

Keywords: older adult · social isolation · tangible user interface

1 Introduction

About one in four older adults in the US report concerns about feeling socially isolated [1]. According to one of the world's longest-running Harvard Longitudinal Study of Adult Development [2], has showed that cultivating a sense of community contributes to both longer and happier lives. The study highlights that developing and maintaining close and meaningful relationships is a crucial aspect of healthy aging [3]. The emergence of digital technologies has made communication more convenient, but these technologies are expensive, and often lack an intuitive and accessible interface for older adults, leading to a greater difficulty in learning and adapting to them [4,5]. Additionally, as individuals age, the skin develops fine wrinkles, rendering biometrics or tactile feedback less effective for this age group [6].

Furthermore, researchers have found that there are issues with non-adoption of technology among older adults and some common reasons include inaccessibility, usability issues, or high costs [5,7,8]. Older adults find technology more meaningful if they find value or personal relevance in using it [9,10] and have abandoned technologies that do not cater to their specific needs and sense of aesthetics [11]. Tangible user interfaces could provide more accessible systems leveraging

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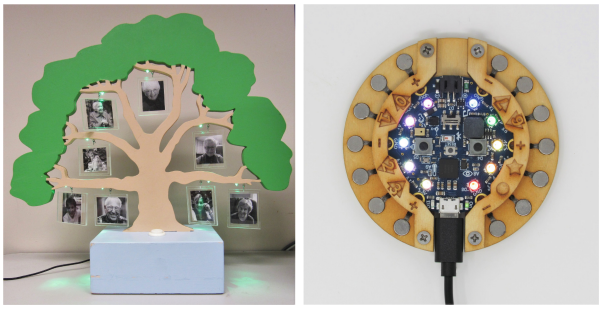


(a) Check-in Tree (b) Check-in Toolkit

Fig. 1. Check-in Toolkit

the use of existing competences and practices through common, familiar interfaces [5,7,12]. Researchers have investigated how to help older adults connect with each other to reduce social isolation by providing tangible electronic systems to check-in with loved ones through one-way [15] and two-way communication [16]. These electronic check-in systems were user-facing physical objects (e.g., a frame or tree) that were envisioned to be on display in one's home.

In this paper, we will discuss two tangible electronic check-in systems which can facilitate multiple users to check-in with each other via a bidirectional many-many connection. The first system is a peer-based, Check-in Tree [16] shown in Fig. 1a. The second system is a novel, peer-based Check-in Toolkit, shown in Fig. 1, that provides older adults with the ability to customize the physical enclosure. An old version of this Toolkit was introduced in a CHI'19 workshop position paper [14]. These novel systems offer relatively cheaper alternatives for a quick, daily check-in compared to digital systems and are developed to provide intuitive, familiar interfaces to facilitate easier integration and technology adoption. They would also help better understand if, when, and how older adults would like to *customize* their check-in processes.

2 System Overview

2.1 Check-In Tree

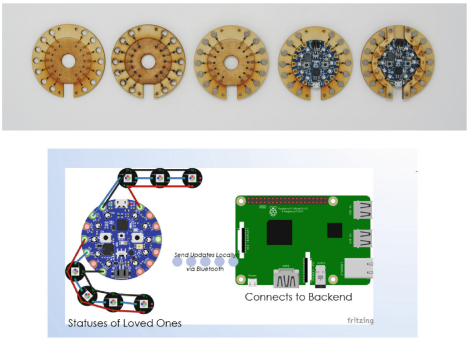
The Check-in Tree [16] is a peer-based check-in system tailored to the check-in needs of older adults. Older adults often use low-tech solutions of common real-life check-in systems (e.g., turning on/off the porch light) to indicate with neighbors that they have woken up. Neighbors will call if a friend has not indicated they woke up. This idea of morning check-in is replicated through the Check-in Tree prototype. The Tree design and specific features were fine-tuned to make it look more aesthetically pleasing based on feedback from three older adult consultants.

Ideally, each older adult in a neighborhood peer-group would have their own Check-in Tree. Each Check-in Tree would have a picture of everyone in their peer-group along with their own picture at the top, as shown in Fig. 1a. When an older adult gets up in the morning, he presses the button on the base of the Check-in Tree, the LED against his picture turns on, and the individual's status appears on the Check-in Trees of all of their peers. In case the LED does not turn on, then a neighborhood peer could check on their neighbor.

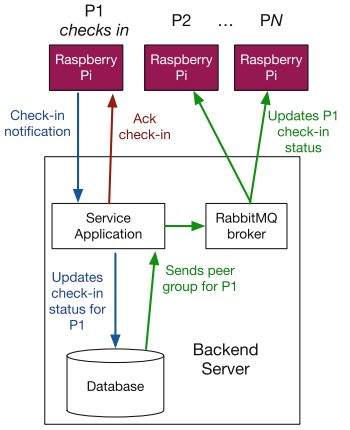
The Check-in Tree is made up of a custom wooden enclosure with a Raspberry Pi 3 stored in the base of the Tree. Each picture is lit up by an LED that is connected to the Raspberry Pi (RPi) via internal wiring through a breadboard. The RPi connects to a central server via a researcher provided internet connection from the older adult's home, as shown in Fig. 1a.

2.2 Check-In Toolkit

The Check-in Toolkit is a novel peer-based check-in system that simulates the functionality of the Check-in Tree and extends Craftec [13]. Craftec empowers older adults to explore electronic interactions by abstracting inputs and outputs on a Circuit Playground Express and associated input and output components. We utilized a Circuit Playground Bluefruit so that it can wirelessly communicate with the technical architecture. The built-in NeoPixel components can visually communicate older adults' availability based on colored lights similar to the Check-in Tree. External NeoPixels can be added to improve scalability. Figure 1 shows a single Toolkit. Multiple Toolkits can be similarly connected via the



(a) (top) Step-wise development of the Check-in Toolkit's physical component and (bottom) Fritzing diagram indicating the Bluetooth connection between the Toolkit and the RPi and the potential for scalability of the system.



(b) Backend Architecture updating check-in status for Participant 1 (P1) for both Check-in Tree and Check-in Toolkit.

Fig. 2. Design and backend architecture of the Check-in Toolkit.

Internet. The Toolkit can be attached to any surface or sewn into any fabric, thereby eliminating rigidity in user interface design. Older adults can use the Check-in Toolkit to enhance any household items to communicate about check-ins or create an artifact that will blend right into their surroundings.

Included in this Toolkit is an Adafruit Circuit Playground Bluefruit with built-in RGB NeoPixels and a Raspberry Pi. The Circuit Playground Bluefruit is connected with a Raspberry Pi via the built-in Bluetooth for wireless communication and the RGB NeoPixels work as LED outputs. Every user in the peer group has one Toolkit and each NeoPixel indicates one participant. The Circuit Playground Bluefruit consists of magnetic connections built into the laser cut balsa wood bases to facilitate easier integration into everyday objects. Each pin on the electronic component is hand sewn with conductive thread to holes in the balsa wood bases that contain magnets. Insulated wires with jewelry clips attached to the ends touch the embedded magnets to allow connections to be easily made between the components. Figure 2a shows the step-wise development of the physical prototype. The bottom part of the figure contains the Fritzing diagram depicting that the RPi connects with the Toolkit via Bluetooth, and that several NeoPixels can be attached to the Toolkit for scalability i.e. the Check-in Toolkit can provide the flexibility to add more people to the peer group unlike the Check-in Tree.

2.3 Technical Architecture

Each electronic check-in system's Raspberry Pi connects to a backend server via the internet as shown in Fig. 2b. When an older adult checks in for the day, the Raspberry Pi sends the message to the backend server where the service application collects the peer-group data from the database and then forwards it to the RabbitMQ broker to notify all the members in the participant's peer-group about their check-in. The RabbitMQ broker utilizes a publish-subscribe protocol where all participants in a peer-group subscribe to the broker. RabbitMQ publishes received notifications from one participant to all subscribed participants in the peer-group simultaneously.

3 Conclusion

This paper discusses two low-cost check-in systems designed to examine their effectiveness in facilitating social connection among older adults. We aim to investigate the utility of offering an intuitive, familiar tangible user interface (Check-in Tree) as well as the ease with which older adults can choose their own preferred user interfaces (Check-in Toolkit). We have fully functional prototypes for both systems and they are ready for deployment. Our future plans involve conducting a field deployment study to compare the systems, aiming to understand user experiences and challenges faced during check-in. This study will inform potential design directions to address these challenges and enhance the effectiveness of check-in systems for older adults.

References

1. Vasold, J.B.K.: 2018 Home and Community Preferences: A National Survey of Adults Ages 18-Plus. AARP Research (August 2019). https://www.aarp.org/research/topics/community/info-2018/2018-home-community-preference.html (Accessed 7 April 2023)
2. Mitchell, J.F.: Aging well: surprising guideposts to a happier life from the landmark harvard study of adult development. Am. J. Psych. **161**(1), 178–179 (2004)
3. van den Berg, P., Sharmeen, F., Weijs-Perree, M.: On the subjective quality of social Interactions: influence of neighborhood walkability, social cohesion and mobility choic. Trans. Res. Part A: Policy Practice **106**, 309–319 (2017)
4. Neves, B.B., et al.: Can digital technology enhance social connectedness among older adults? A feasibility study. J. Appli. Gerontol. **38**(1), 49–72 (2019)
5. Joshi, S.G., Bråthen, H.: Lowering the threshold: reconnecting elderly users with assistive technology through tangible interfaces. In: Zhou, J., Salvendy, G. (eds.) ITAP 2016. LNCS, vol. 9754, pp. 52–63. Springer, Cham (2016). https://doi.org/10.1007/978-3-319-39943-0_6
6. Reedman, C.: Fingerprints and human inspection: a forensics perspective, pp. 221–230 (Jan 2013). https://doi.org/10.1049/PBSP010E_ch12 ISBN: 9781849195027
7. Spreicer, W.: Tangible interfaces as a chance for higher technology acceptance by the elderly. In: Proceedings of the 12th International Conference on Computer Systems and Technologies, vol. 2011, pp. 311–316 (2011)
8. Chu, C., Rebola, C.B., Kao, J.: BUMP: bridging unmet modes of participation. In: Proceedings of the 2015 British HCI Conference, pp. 261–262 (2015)
9. Mitzner, T.L., et al.: Older adults talk technology: technology usage and attitudes. Comput. Hum. Behav. **26**(6), 1710–1721 (2010)
10. Fausset, C.B., Harley, L., Farmer, S., Fain, B.: Older adults' perceptions and use of technology: a novel approach. In: Stephanidis, C., Antona, M. (eds.) UAHCI 2013. LNCS, vol. 8010, pp. 51–58. Springer, Heidelberg (2013). https://doi.org/10.1007/978-3-642-39191-0_6
11. Ballegaard, S.A., Bunde-Pedersen, J., Bardram, J.E.: Where to, Roberta? Reflecting on the role of technology in assisted living. In: Proceedings of the 4th Nordic Conference on Human-computer Interaction: Changing Roles, pp. 373–376 (2006)
12. Rebola, C.B., Jones, B.: Sympathetic devices: designing technologies for older adults. In: Proceedings of the 31st ACM International Conference on Design of Communication, pp. 151–156 (2013)
13. Jelen, B., et al.: Craftec: engaging Older Adults in Making through a Craft-Based Toolkit System. In: Proceedings of the Thirteenth International Conference on Tangible, Embedded, and Embodied Interaction, pp. 577–587 (2019)
14. Bhowmick, P., Nurain, N., Connelly, K., Siek, K.: Design and evaluation of electronic check-in systems for older adults. In: CHI Conference on Human Factors in Computing Systems: Workshop on Designing Interactions for the Ageing Populations - Addressing Global Challenges (2019)
15. Rowan, J., Mynatt, E.D.: Digital family portrait field trial: support for aging in place. In: Proceedings of the SIGCHI conference on Human factors in computing systems , pp. 521–530. ACM (2005)
16. Arreola, I., Morris, Z., Francisco, M., Connelly, K., Caine, K., White, G.: From checking on to checking in designing for low socio-economic status older adults. In: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, pp. 1933–1936. ACM (2014)