engineering proceedings

MDPI

Proceeding Paper

Navigating the Divide: Digital Kiosks and Mobile Apps as Complementary Human-Centered Self-Service Technologies †

Amani S. Aljohi, Sara S. Alzaabi, Rahma S. Almahri, Georgios Tsaramirsis and Oussama H. Hamid *

Faculty of Computer Information Sys, Higher Colleges of Technology, Abu Dhabi P.O. Box 41012, United Arab Emirates; amani.sjohi@outlook.com (A.S.A.); H00385483@hct.ac.ae (S.S.A.); H00413872@hct.ac.ae (R.S.A.); gtsaramirsis@gmail.com (G.T.)

* Correspondence: ohamid@hct.ac.ae

† Presented at the International Conference on Recent Advances in Science and Engineering, Dubai, United Arab Emirates, 4–5 October 2023.

Abstract: This work sheds light on the effectiveness of digital kiosks in targeting specific audiences in contrast to centrally managed mobile phone applications. To this end, we have conducted a case study where a digital kiosk was developed to support the academic activities of the computer science department. Our results show that the students continue to use the mobile phone application. However, the digital kiosk added the following main benefits to the service: Firstly, being in a physical location and thanks to their larger screens, digital kiosks are 'eye-catching' devices, which makes them ideal for advertising products/services or communicating relevant information. Secondly, they are brilliant points of attraction. By seeing other people standing in front of any of them, members of the target audience are encouraged to imitate them, even if they did not have the intention to do so. Thirdly, even if the services are available from a mobile phone application, some people do not wish to create an account, download and install the application on their devices, and/or give permission to it, which can potentially invade their privacy and security. Lastly, and equally important, digital kiosks are human-centered technologies that can be more appealing to people who seek social interactions. With this, we conclude that digital kiosks cannot replace mobile phone applications. Rather, they are further technologies that enhance self-service overall.

Keywords: self-service technologies; digital kiosks; mobile applications; service points; human-machine interface; human-centered technologies

check for updates

Citation: Aljohi, A.S.; Alzaabi, S.S.; Almahri, R.S.; Tsaramirsis, G.; Hamid, O.H. Navigating the Divide: Digital Kiosks and Mobile Apps as Complementary Human-Centered Self-Service Technologies. *Eng. Proc.* **2023**, *59*, 162. https://doi.org/10.3390/engproc2023059162

Academic Editors: Nithesh Naik, Rajiv Selvam, Pavan Hiremath, Suhas Kowshik CS and Ritesh Ramakrishna Bhat

Published: 15 January 2024

Copyright: © 2024 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (https://creativecommons.org/licenses/by/4.0/).

1. Introduction

Self-service technologies are cyber–physical interfaces that allow service consumers to interact with the service provider with the least requirement of human resources [1,2]. Examples include digital kiosks, online portals, mobile phone applications, interactive voice response systems (over phone calls), virtual assistants and chatbots. It is worth noting that virtual assistants and chatbots are software applications that run on another platform, such as a mobile phone application, a website or a digital kiosk. Web-based portal websites are highly versatile and can be accessed from any of the devices mentioned above, given that they are connected to the internet.

Digital kiosks are interactive self-service technologies [3] that provide information, services and even products to their users. The kiosks are usually equipped with touch-screens, cameras, and sensors that enable users to complete transactions, access information, and interact with digital content. Some digital kiosks support advanced user interaction devices such as leap motion for touchless user input or holographic projectors for a more immersive output [4,5]. Even with all their advancements, digital kiosks are not as popular as websites or mobile phone applications [6]. Organizations tend to rely more on web- and mobile-based technologies rather than digital kiosks.

The main benefits of these technologies are their high availability through reduced need and seclusion from human resources. For example, a customer can either book a cinema ticket from the comfort of home via a mobile phone application or via a digital kiosk outside the cinema, without the need to stand in a lengthy queue.

While in theory offering overlapping services, smartphones and digital kiosks often serve distinct purposes. The mobility of smartphones allows them to be used anywhere, while digital kiosks require users to be in the same physical location to use them. However, this is not necessarily a disadvantage. It rather means that they are more secure and reliable, as the operator has total control over the device. This allows them to be used as identification points at airports, cash payment points, ticket issuing and many more locations.

Mobile phones and mobile phone applications are designed to offer a personalized and private experience to their users, while digital kiosks are designed for public use, using the same graphical interface in a large easy-to-see screen. Additionally, the kiosks do not include any personal information. These properties make them ideal for collaborative use. For example, two or more users can look at the same screen with ease and decide which movie they want to watch. Another collaborative scenario is a user asking assistance from someone else on how to do a task.

Given the overlapping offering of services from the various self-service platforms and in light of the de facto privileges of mobile phone applications, one might think that other self-service technologies such as digital kiosks are redundant or even obsolete. This misconception may lead to the false conclusion that the various self-service technologies are competing with each other. Indeed, research on self-service technologies implied that the more heterogeneous the provided self-service platforms are in terms of type, the higher the satisfaction of service consumers [7].

In this paper, we focus on the two most distant self-service platforms, digital kiosks and mobile phone applications, and via a case study, we analyze why the two technologies are rather complementing instead of competing with each other.

The rest of the paper is organized as follows. In Section 2, we introduce the developed digital kiosk. We then present and discuss our findings in Section 3, only to conclude our work in Section 4.

2. Materials and Methods/Methodology

In order to test our hypothesis, we developed a digital kiosk that offers our students department-related services. The majority of these services also exist on our college's portal, which is available as a website and mobile application. However, since the digital kiosk is managed locally by the department, it can offer some extra information related to the department without the need for additional permissions.

2.1. Apparatus

As part of this work, we have developed a digital kiosk (Figure 1) for serving the needs of the department. The device includes a 15″ touch screen, connected to a Windows 11 Mini PC with the AMD Ryzen 6800U CPU, 32 GB of DDR5 Ram and 512 NVME SSD. The system was placed on the top at a 1.4 m stand with a rotation for easier use. The device includes an external USB-powered soundbar without battery positioned at the back of the column.

2.2. Software Application

The main menu includes 20 options that are dynamically loaded from a JSON file (Figure 2). Each option includes a unique ID, description in English, a description in Arabic and the address of a local or remote folder. This allows the department secretary to dynamically change all the options based on the needs of the department simply by editing the file, placing the corresponding content in a folder that is hosted locally in the digital kiosk. The digital kiosk is capable of displaying images, text, videos and audio

by using different templates that are automatically picked based on the content of the corresponding folder.



Figure 1. The devised digital kiosk.

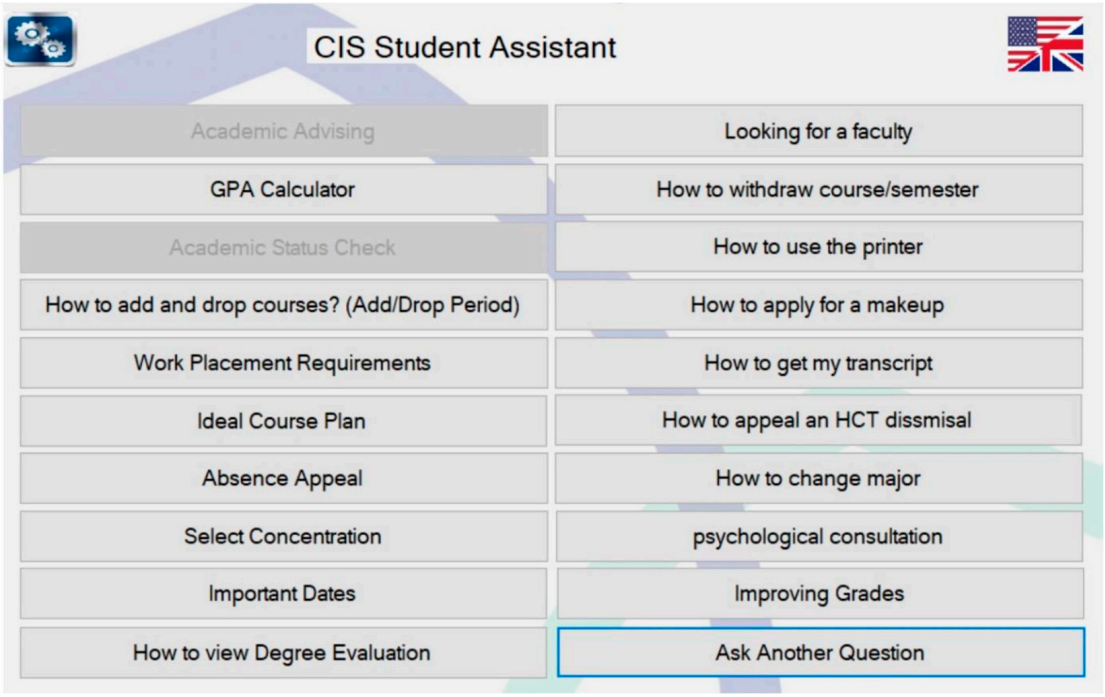


Figure 2. The main menu of the digital kiosk.

All the content files, irrespective of their type (video, image, text), are named as incrementing numbers starting from 1 and following the type extension, for example, 1.jpg or 1.txt. The file name is used as an index, so that the system knows, when being in a specific page, to utilize the corresponding text file for the speaking option. In case there is no such text file, the 'Speak' button will be disabled, meaning that it cannot be pressed. In order for the system to read the text, it is designed to use the Windows Speech Synthesizer. Currently, this feature is available only in English. The 'Previous' and 'Next' buttons will only appear if there is more than one content page. The 'Close' button allows the user to close this page and go back to the main menu. The system includes a timer that closes the form and goes back to the main page, in case the user does not click on the close button. The timer can be programmed separately before each option through the JSON file. If the main page is not active for an amount of time that is also specified in the JSON file, then the system will display images from a specified screensaver folder.

2.3. Data Collection

The system includes a built-in logs system that allows it to generate feedback. When the user clicks on any option, the system saves the date and time. Once the user clicks on the close button or the timer expires, the system will add an entry to the log file similar to that shown in Table 1.

Table 1. The log file.

Start Date Time	Finish Date Time	Selection	Value
01/03/2023 15:42	01/03/2023 15:44	GPACalc	1.8
01/03/2023 15:44	01/03/2023 15:44	Character	1
01/03/2023 15:45	01/03/2023 15:46	GPACal	1.8
16/03/2023 19:36	16/03/2023 19:37	Faculty	6

The entries in Table 1 include the following: The 'StartDateTime' column is the date and time that the user clicked on the option. The 'FinishDateTime' column is the date and time that the user clicked on the 'Close' button or that the timer expired. The 'Selection'

column shows the unique ID of the selected option and the value in the selection. The 'Value' column allows us to have some additional information about the selection, without violating the privacy of the user. By default, we only save the page index as a value. However, for some options like the GPA calculator, we save the GPA of the user. In some cases, the value is a series of actions. For example, in the application settings, we store if the user entered the password correctly or not.

The device was put in a central place at the entrance of the department, next to the desk of the department secretary. Although it was not advertised and the students were not made aware of it, the device had more than 200 logs in 20 days. Most of the logs were about the schedule of the faculties, followed by 'makeup appeals,' the 'GPA calculator' and the 'academic calendar.' Based on the results of an interview with the department secretary, the kiosk was very well received by the students because it offered them fast and convenient access to information. Also, it allowed the department secretary to help the students do things such as applying for makeup exams, without having to go through the website or the mobile application. While the digital kiosk did not replace the website (portal), it served as a fast interface for the official portal.

3. Results and Discussion

Based on our investigation, we found that although both technologies tend to excel in different areas, they are, indeed, complementing each other. The following are the most notable findings. Table 2 summarizes our main findings.

Table 2. Comparison between digital kiosks and mobile apps.

Aspect of Comparison	Digital Kiosks	Mobile Apps
Ubiquity	Physical on-site presence	Online anywhere/anytime
Type of information	Always on display feature	Notifications provider
Human-centricity	Enables social interaction	Human–machine interaction
Usability	No need for user account	Requires user account

3.1. From the Service Consumer Point of View

Digital kiosks have a feature called 'always on display', which enables them to constantly display dynamic information. On the other hand, mobile phones can provide notifications. Depending on the scenario, both have their benefits. Always on display is better when the audience is physically there, while notifications can provide information anywhere. However, both are required, and this is why places such as airports still use flight information screens.

Another aspect of being 'always on display' is that digital kiosks are 'eye-catching' instruments, which makes them ideal for advertising products/services or communicating relevant information, with the limitation that the audience must be in the same physical location. In particular, digital kiosks are brilliant points of attraction. By seeing other people standing in front of one, users are encouraged to join, even if they have not had the intention to do so.

Furthermore, digital kiosks can be more appealing to people who seek social interaction or assistance on how to consume a service. This makes digital kiosks a good example of a human-based technology [8]. On the other side of the spectrum, mobile phone applications are designed to be used by individuals with the need for limited interaction for the completion of a service. This has the advantage of privacy and security as well as mobility, and it is a device that people tend to have with them all the time. Additionally, the fact that digital kiosks actually have larger screens and interaction points that are easier to access makes them ideal for supporting not only people with disabilities, but also other specific audiences, for example, a customer who wants to book a ticket for a movie in a cinema without the employee having to invade the privacy of the mobile phone.

There is another positive aspect of digital kiosks which relates to human behavior. Namely, even if the services are available from a mobile phone, people sometimes do

not wish to create an account and download and install the application on their devices, especially in the case of services that are not consumed often.

Digital kiosks are intended for a more focused audience. For example, a computer science department can input information relevant to computer science students, without causing confusion to students from other majors. Additionally, by tailoring information to students' requirements, concerned students can be served through digital kiosks without causing confusion to students from other departments. In particular, with their more focused audience, digital kiosks can display a wider range of content, enjoying a liberal policy on what is shown.

3.2. From the Service Provider Point of View

Digital kiosks are controlled environments with specific hardware, designed to operate in a certain environment. This makes the application development easier in comparison to mobile phones, since the latter have different types of operating systems, versions, screen sizes and so on. In addition, unlike mobile phone applications, there is no need to update the digital kiosk application according to the latest standards of distributors such as Google Play and Apple Store. However, digital kiosks tend to be more expensive to build due to the hardware and software as well as operation and maintenance, as their physical location requirements add to the cost. Also, they may be difficult to maintain, especially in remote locations.

4. Conclusions

Both digital kiosks and mobile applications fall under the category of self-service technologies. The two technologies solve different aspects of the self-service problem. Mobile phones excel in cases where no physical presence is required. The opposite is true about digital kiosks, as they are used in numerous applications, such as express lanes, sales points, verification points and other similar types of self-service.

Mobile applications, website applications, and digital kiosks are all digital touchpoints that can be used by businesses to provide a seamless omnichannel experience for their customers. While, in theory, these are competing technologies, they are designed in different ways, often fulfilling diverse purposes. Specifically, mobile applications are designed to be downloaded and installed on mobile devices such as smartphones and tablets. This makes them a brilliant choice whenever privacy and personalized experience as well as mobility and everywhere availability are required. Website applications are similar to mobile applications in that they provide access to services and products through a web browser. Digital kiosks are stationary devices designed to provide self-service options to customers. They are typically used in public spaces, such as shopping malls, airports, and hospitals, allowing customers to access information, place orders, and make payments.

Author Contributions: Conceptualization, O.H.H. and G.T.; methodology, O.H.H.; software, G.T., A.S.A., S.S.A. and R.S.A.; validation, A.S.A., S.S.A. and R.S.A.; formal analysis, O.H.H. and G.T.; investigation, A.S.A., S.S.A., R.S.A., G.T. and O.H.H.; resources, G.T. and S.S.A.; writing—original draft preparation, G.T. and O.H.H.; writing—review and editing, O.H.H. and G.T.; visualization, R.S.A., A.S.A. and S.S.A. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The data can be obtained from the corresponding author upon request.

Acknowledgments: The authors would like to thank the anonymous reviewers of the manuscript for their thoughtful comments and helpful recommendations.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Guan, X.; Xie, L.; Shen, W.G.; Huan, T.C. Are you a tech-savvy person? Exploring factors influencing customers using self-service technology. *Technol. Soc.* **2021**, *65*, 101564. [CrossRef]
2. Kaliappen, N.; Hassan, A. Digital Trends in Asian Hotel Industry. In *Technology Application in Tourism in Asia: Innovations, Theories and Practices*, 1st ed.; Hassan, A., Ed.; Springer Nature Singapore: Singapore, 2022; pp. 147–163.
3. Girsang, R.K.; Sumiati, S.; Djawahir, A.H. The influence of self-service technology and customer relationship marketing on customer loyalty mediated by customer satisfaction. *J. Apl. Manaj.* **2021**, *19*, 217–228.
4. Georgiou, O.; Limerick, H.; Corenthy, L.; Perry, M.; Maksymenko, M.; Frish, S.; Müller, J.; Bachynskyi, M.; Kim, J.R. Mid-air haptic interfaces for interactive digital signage and kiosks. In Proceedings of the Extended Abstracts of the 2019 CHI Conference on Human Factors in Computing Systems, Glasgow, Scotland, UK, 4–9 May 2019; pp. 1–9.
5. Elmorshidy, A. Holographic projection technology: The world is changing. *arXiv* **2010**, arXiv:1006.0846.
6. Fanini, B.; Ferdani, D.; Demetrescu, E.; Berto, S.; d'Annibale, E. ATON: An open-source framework for creating immersive, collaborative and liquid web-apps for cultural heritage. *Appl. Sci.* **2021**, *11*, 11062. [CrossRef]
7. Hossain, M.S.; Zhou, X.; Rahman, M.F. Customer satisfaction under heterogeneous services of different self-service technologies. *Manag. Mark.* **2019**, *14*, 90–107. [CrossRef]
8. Smith, N.; Teerawanit, J.; Hamid, O.H. AI-driven automation in a human-centered cyber world. In Proceedings of the 2018 IEEE International Conference on Systems, Man, and Cybernetics (SMC), Miyazaki, Japan, 7–10 October 2018; pp. 3255–3260.

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.