Framework for the provision of information services through a smart self-service kiosk at the National University of Lesotho Library

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A smart self-service kiosk (SSSK) in a library ensures that users are able to access library services without the help of librarians regardless of the location. An SSSK is web-based and allows library users to access library services remotely. Library users are able to check the availability of information resources, the location of the information resources, and the number of copies of a particular information resource in a particular library. This study sought to investigate the provision of information services at the National University of Lesotho (NUL) Library with a view to suggest a framework for implementing an SSSK. It could be like a point-of-sale self-service touch-screen kiosk check-out, like those used in supermarkets up and down the country, an information point in a tourist attraction, or a kiosk in an airport that allows people to check in without joining a counter queue. An SSSK would be different for every specific field, depending on the specific planned application. In the field of library and information sciences, an SSSK would be used to search for the availability of books, the location of books and to check a book in and out of the library. For this study a literature review was conducted to demonstrate a need for a framework which involves the provision of information services through an SSSK at the NUL Library. The study identified the need for an SSSK to provide reference and information services at the NUL Library. This includes searching for the availability of information resources or just books like elsewhere, the location of such information resources, as well as the self-checking in and out of information resources in the library. The library users through the web portal of the SSSK would also be able to access the library services remotely. The study proposes a framework to provide information services through a SSSK at the NUL Library. It is hoped that the proposed framework may serve as a benchmark and guideline for the provision of information services through a SSSK at the NUL Library.

1 Introduction

Smart self-service kiosks (SSSKs) are used in many settings including libraries. For example, shops in some developed countries use SSSKs for consumers. Furthermore, train stations and subways also use SSSKs for the purchase of travel tickets. These kiosks reduce time for customers to queue for the same services at shops. Customers are able to view the menu, select the items they want to order, pay for their order and send the order through to the cashier for further processing (Patel 2015:10). The SSSK will then print the order number and slip to the customer who will have their proof of purchase. These devices do not only decrease the average waiting time, which at peak hours can reach up to 10 minutes, but also allow the customers to personalise their choices according to their needs (Pezzini 2020:5). Libraries also use the SSSKs to provide library self-services to the users. The users can through the SSSK search for the availability of books, check the books in and out and also renew books without the help of a librarian (Park, Kim & Hyun 2021:90).

The implementation of the SSSK in libraries ensures that users are able to access the library services without the help of information librarians regardless of the location. The SSSK is web-based and allows users to access the library services remotely. The library users are able to check the availability of an information source, its location, and the number of copies of a particular information source available in a particular library. The users are able to have access to this information without the assistance of the information librarian and even without physically having to go to the library. A SSSK is one of the most diverse technological forms of smart service technology (SSTs) (Vakulenko, Oghazi & Hellstrom 2019:265), basically a small, stand-alone intelligent machine which provides information and applications on education, commerce,

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entertainment, and other topics. Kiosks are popular due to the number of advantages they provide (Wani 2019:4). As already mentioned, with the SSSK, on-campus users can access the library services without the help of the information librarian. The off-campus students through the artificial intelligence (AI) powered web portal, can access the information services of the library remotely. Tredinnick (2017: 37) as well as Cox, Pinfield and Rutter (2019:419) define AI as "a cluster of technologies and approaches to computing focussed on the ability of computers to make flexible rational decisions in response to unpredictable environmental conditions" In simple terms, Tella and Ajani (2022:15) define AI as the simulation of human intelligence processes by computer systems. The literature already has a record of libraries that make use of AI powered technologies such robots which have revolutionised the provision of information service (Tella 2020:15). For instance, the University of Pretoria in South Africa is one of the first universities in Africa to acquire a robot (Libby) in pursuit of improving service delivery (Tella & Ajani 2022:17).

With the help of SSSKs, a library can also provide easy and fast library information to users like library OPAC (books/journals/bound volumes), bibliographic library information, and access to online library resources (Vakulenko et al. 2019:265). Despite the importance of SSSKs in the provision of information, libraries in developing countries such as Lesotho, Botswana and South Africa do not use SSSKs to provide quality remote services to patrons. The only kind of kiosk they use is one limited to check library books in and out (Wani 2019:6). However, the users cannot receive library books via drone services in their homes. The users can only benefit from the services at a kiosk when they physically visit the library (Kaur & Malhotra 2018:265). Hence, the study recommends a kiosk that will enable the users to receive the library books even when requested remotely.

SSSKs can clearly improve the student experience in that they can access information resources at a university library without much effort. They can provide multiple kinds of information and resources in one place and thus save users' time. SSSKs can also provide quick and fast library services to users like bibliographic, catalogue, OPAC, library sources and resources, and the checking in and checking out of books (Wani 2019:4). There are several potential benefits for libraries using SSSKs for the provision of information services. Providing helpful touchscreens for students can reduce the workload and paperwork for staff who specifically provide the information services. In some cases, SSSKs could even help to reduce libraries' personnel needs for certain functions in the library. A SSSK facility provides a faster and more efficient way of borrowing and returning books (Vakulenko et al. 2019:266). This does not only mean fewer queues to be served at the information desk, but it also frees up information librarians' time from routine transactions so they can attend to other library matters and provide front-line help where it is most needed in the library (Curran & Meuter 2005; Yang & Klassen 2008; Wani 2019).

In order to improve their library service, some libraries are enhancing their visibility by introducing digital libraries (Becker et al. 2013; Boateng & Liu 2014). Other libraries, however, are relying on self-service technologies (SSTs) to provide customised services to their users (Hsiao & Tang 2015:120). SSTs are the technological interfaces that enable library users to get their services done without having to involve information librarians (Meuter, Bitner, Ostrom and Brown 2005; Ul Hassan, Iqbal & Habibah 2020). Interactive information service kiosks can be used in libraries to make the reference system of the libraries highly effective (Kaur & Malhotra 2018:266). According to Leung and Matanda (2013:550), SSSKs also support places like libraries by decreasing the costs associated with staff training, equipment, and communication. Similarly, Lee & Baek (2014:245) as well as Hamad, Al-Fadel & Fakhouri (2022:10) argued that the adoption of new technology and digital trends will lead to an improved product and service quality. Furthermore, the implementation of smart technologies is viewed by Gul & Bano (2019:280) as well as Hamad et al. (2022:10) as a way of bridging the gap between the provision of library services and the evolving needs of library users.

A number of studies have been undertaken that were aimed at either improving or evaluating the library services at the NUL (Khaola & Mabilikoane2015; Tseole & Ngulube 2022). However, this study focuses on the provision of information services at the NUL with a view to developing a framework. A framework may help the NUL Library to provide library services to the users who request them remotely through the use of intelligent robotic machines. In this regard, the users may benefit by accessing the library services without having to physically visit the library.

2 Context of the study

The NUL is the main and oldest university in Lesotho, located in Roma, 34 km (21 miles) southeast of Maseru, the capital of Lesotho. Senate is the principal authority of the University while the council acts as the supreme governing body of the university. Both Council and the Senate have been established by the Act number 13 of 1975 (NUL 2006/07 calendar 2007:25. The National University of Lesotho supports open access and has signed the Budapest Open Access Initiative in 2011. The basic principle of this initiative is to remove all access barriers related to scholarly material in order to improve education and research for both the rich and the poor (Creaser 2011:60). In 2011, the NUL established the first institutional repository in the country, the National University of Lesotho Institutional Repository (NULIR), providing access to the research output of staff and students (Tlalis Destination Guide 2022:25).

The hub of the NUL Library and Information Services is located in the Thomas Mofolo Library Building on the main campus at Roma. The NUL Library plays a central role in ensuring the fulfilment of the core academic initiatives of the University. "The library strives to provide a dynamic information service to its clientele in order to give practical meaning to the University's purpose as a centre of excellence in learning, teaching, and research" (Matsieng Destination Guide 2022:27). Whereas the NUL Library and its information services have an open-door policy whereby walk-in users may enter reading rooms, only eligible users may borrow items and get passwords to access online e-resources remotely. Those entitled to these privileges comprise:

- Bona fide students at the University.
- Any staff member of the University as defined in the appropriate University statutes.
- Any extra-mural member approved by the Library Board.
- Visiting research fellows and/or professors.
- Others may make the necessary arrangements with the library authorities (Tlalis Destination Guide 2022:27).

The NUL Library comprises of the Thomas Mofolo Library as the main library at the Roma Campus; and the site libraries at the Institute of Extra Mural Studies (IEMS) in Maseru. The library offers a mobile library service, primarily for IEMS students and teaching staff in remote areas (Matsieng Destination Guide 2022:27).

3 Problem statement

The current information services at the NUL Library are limited to checking the availability and the location of information resources. Apart from checking the availability and the location of the information resources, the information desk cannot perform any other services (NUL 2022:230). The problem is that the information desk of any academic library, including the NUL Library, operates within the operational hours of that library (NUL Library 2022:230). For instance, the normal NUL Library operating hours are from 7:00 to 22:30 during the week and from 9:00 to 17:30 during the weekends, while it is closed during public holidays (NUL Library 2022:230). When the Library closes, users do not use the services of the information desk effectively because they would have to speak to an information librarian for further assistance. A SSSK would ensure that apart from checking the availability and location of information sources, the users can make use of other library services that are embedded in it. Such activities among others might include the checking-in and checking-out of information resources.

The SSSK will also ensure that the information service desk operates 24/7 so that users would have unlimited access. When the library is closed either during holidays or pandemics such as Covid-19, the users can still use the smart library app to lock their requests. Through AI software the request would be received by the robotic machine based in the library. The intelligent robotic machine would access the information resource from the shelves and package on the library drone according to the personal information provided by the remote user. The drone would then deliver to the user based on the address captured to ensure the information resource is delivered to the right user. The SSSK would also ensure that queues are eradicated at the library's information service desk (Mardiana & Muhammad 2017:17). Therefore, this study intends to investigate the possible adoption of an SSSK for the provision of information services at the NUL Library.

4 Literature review

The current section presents the literature review related to the implementation of SSTs and SSSKs in the library context. The following are discussed as part of the literature review: Self-service technologies for libraries and the various functions of library SSSKs.

4.1 Functions of smart self-service technology in libraries

Kaur and Malhotra (2018:268) opined that "today's libraries make use of the latest technologies for the ease of its users." Libraries and librarians are usually very much technology oriented and try to use the latest technologies that could make library services more efficient. Investing in self-service and inventory productivity equipment can therefore enable a library organisation to make the best use of its finite personnel budget (Breeding 2015:1). According to Wani (2019:3), "library SSKs serve two main functions including check-out and book return." With the help of a self-service provider kiosk, book check-out and book return become more efficient for both the staff and students (Wani2019:3). Not only does this translate into less queues, but it also frees up library staff time from routine transactions so they can answer queries and provide the frontline help where it is most needed (Wani 2019; Kaur & Malhotra 2018; Dempsey 2010).

Hsiao and Tang (2015) argue that the implementation of SSTs in libraries has widespread implications because "it can modernize library services and aid them in providing a better, more personalized experience." According to Dempsey (2010:24), "self-service options such as self-check machines, drive-through windows, vending machines with books and DVDs, as well as a host of internet-driven tools that enable library users to register for library cards proliferate." Self-service

technologies range from traditional offerings such as hotel check-in/out facilities to newer platforms such as a mobile app-based grocery delivery service (Park, Kim & Hyun 2021; Ul Hassan, Iqbal & Habibah 2020). Contrary to conventional in-person service, self-service technologies provide a myriad of advantages that reduce operational costs and provide high productivity in delivering service and increased customer satisfaction and loyalty (Park, Kim & Hyun 2021:80).

In the context of libraries, SSSTs refer to a method of providing service to the user using technology, rather than through the librarian as a primary facilitator (Hutchinson 2020:25). Integrating SSTs into an academic library context provides users with numerous service options. For instance, users can use library services on their own instead of having to seek help from information specialists or they use both, and this creates a more satisfactory experience because of the freedom of choice to use an SSST or consult with a librarian or both (Hutchinson 2020:25).

4.2 Performance of smart self-service technology in libraries

When using smart self-service technology such as AI and the internet of things (IoT), librarians are no longer required to be present for monitoring the information services and collection circulation (Verhagen & Van Dolen 2009; Chaouali & El Hedhli 2019). Libraries strengthen the performance of smart self-service technology to prevent possible fraudulent activities that can take place especially when librarians are no longer available to monitor the services (Karna, Pratama & Ramzani 2021:5). The following functions can be strengthened to enhance quality performance:

- Self-service technology such as a self-loan service should provide indicators about accepted/rejected RFID (radio-frequency identification), both for the patron and the collection(s). The patron can receive an automatic SMS from the library indicating that their request for a particular service has been either accepted or rejected. The patron must also have the opportunity to follow up robotically (Keyser2017:250).
- Self-service technology should capture the image of the patron borrowing the collection(s). Smart technology such as AI and the IoT should capture the image of the patron and the RFID should be able to communicate with other systems through networks whenever the patron accesses the library and uses the library remotely (Mohammadi & Yegane 2021:77).
- Self-service technology such as drones should be used to deliver books to the doorsteps of the patrons that are not too far from the library depending on the capacity of the drones. Some other drones have the capacity to deliver books further away from the library (He, Liu & Wang 2017:725).

In some libraries, an intelligent robotic machine can be placed at the information services to answer enquiries from users who want services in the library. Such a robot can provide users with information about the availability of a book, the location of the book and indicate how many copies are available in the library (Mathibela 2019:17).

5 Methodology

This qualitative study depended on the use of a literature review to present a sensible and factual synopsis of research evidence for the topic in this research (Brereton, Kitchenham, Budgen, Tuner & Khalil 2007:575). The study conducted a literature review to establish a need for a framework for the provision of information services through a smart self-service kiosk at the NUL Library. The authors utilised keywords and phrases in the themes of the literature review to search for relevant literature on Google Scholar and did a Google search which also linked to scholarly databases like Sage and Emerald to gain access to suitable literature sources for the study. Keywords and phrases utilised to conduct the literature searches were drawn from the title of the study, as well as from the themes in the content of the paper to get appropriate sources that address the study. These include information services, smart self-service kiosk, reference services, and the NUL Library. Abstracts were first evaluated via an annotated bibliography to determine the appropriateness of each source.

6 Findings

SSSKs enable libraries to provide information services remotely and as a result, users do not have to physically visit the library facilities to access the library services. Through the AI empowered software and application, users can browse the collection of the library and see what is available and what is not available. A user can also loan the book remotely and the book could even be delivered to the user through the use of a drone. Investing in self-service and inventory productivity equipment can enable a library to provide services remotely. Such services include the following: self-check-out and self-return services of books. With the use of an SSSK, these services can be more effective and efficient for the users. Drones could even potentially be used to return books to the library. Fernandez (2016:1) defines a drone as an unmanned AI powered aerial vehicle, a robot that combines flight with sensors (usually cameras) to facilitate unprecedented freedom in observing and interacting with the world and libraries are already making use of these technologies to support their patrons. Likewise, Saloi (2021:5) suggested that "in the library drones can also be used in the best way to provide the required

documents to that type of users who are staying far away from the library or who cannot manage the time to visit the library for different reasons whether it is personal or official." Additionally, services such as Uber can also be used to send and receive books between users and the library. The use of AI and IoT enables the SSSK to perform effectively and efficiently in providing quality remote services to the users. Through RFID, intelligent robotics and drones the library will eventually be able to receive requests through computer technology and should be able to provide quality services to users.

RFID can be used to ensure there are security measures in place to avoid fraudulent activities that could take place in libraries. RFID will ensure that networks and systems communicate so that the books requested remotely by users reach the correct user. Once the books are received either by the patron or the library, an SMS will be dispatched to confirm the receipt of the books. Intelligent robotic machines can answer enquiries from users and direct them to where the books they need are located. Such an intelligent robotic machine can also inform users on the availability of books and on the number of copies the library has. AI embedded robotic machines will assist patrons to access the library services easier and quicker while the information librarians are freed up to focus on the strategic functions of the information services provided in the library.

7 Recommendations

This section presents the framework proposed for the provision of an information service through the SSSK in academic libraries. The use of the SSSK can benefit the NUL Library in providing not only information services but also remote services to the users, hence a framework for the provision of information services through the SSSK is recommended and presented in figure 1. The framework is discussed on the basis of the following: the library shelves, internal and remote access. The smart self-service kiosk can be used to provide services to both users accessing services from the on-campus library and those who can access the library services remotely.
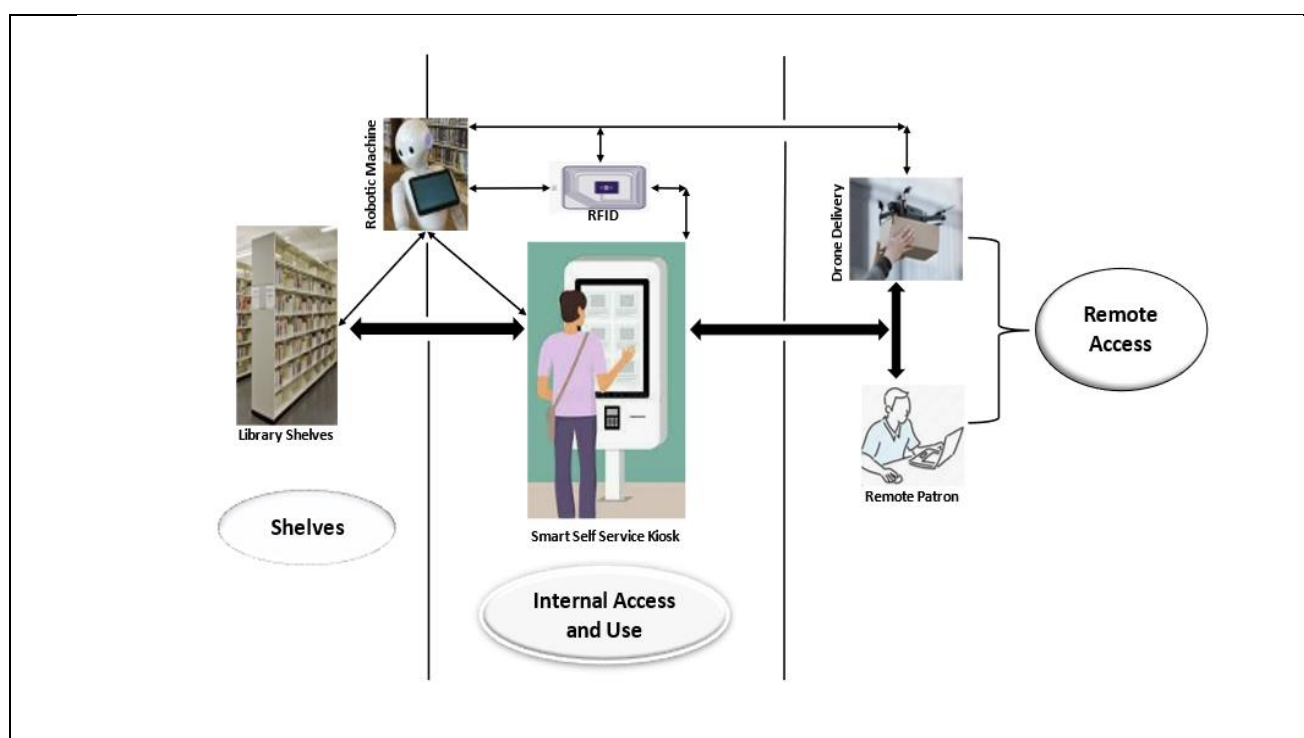
Figure 1: Framework for the provision of information services through a smart self-service kiosk in the library

This framework begins with the user accessing the library services in the library through the use of the SSSK. The patron checks the availability of the book using the SSSK and places an order, and once the book is available, the kiosk will through RFID communicate with the intelligent robotic machine to collect the book from the library shelves. Upon receiving the book, the patron will desensitise the book on the SSSK and start using the book. If the book is not available, the SSSK will indicate where the book is, and when the book should be returned to the library. The SSSK will also indicate the number of copies the library has. Once the book is returned to the library, the user will receive an SMS from the library that the book has been returned and is now ready to be collected. In this case the patron will be able to use self-service through the SSSK.

The second part of the framework is about the remote access to the library through using the SSSK. A patron will use computer technology to access the SSSK of the library. The patron will access the SSSK through a smart library application

(app) that can be downloaded onto their cell phones and laptops. The patron will then be able to access the library database and browse through the library collection. The patron will select and order the book remotely. Through RFID the order will be sent to the intelligent robotic machine so that the books can be collected from the shelves. The intelligent robotic machine will put the books on the library drone and enter the physical address of the patron. When the package is well-placed on the drone the drone will start flying to the location where the patron is based. Through RFID the patron will be made aware that the order is on the way and the time it is expected to arrive. Once the drone arrives, it will drop the books and take a picture of the patron to verify that the order has been received by that person. Through the photo, the library will confirm that the books have been issued and were received by a specific patron. The patron can return other books in their possession to the library using the drone. If a patron orders a book remotely and the book is not available, the SSSK will indicate to the patron that the book is not available and also when it will become available.

Once the book is back in the library, the patron will be informed through an SMS that the book is back, and it will be dispatched through the drone. Once the order is dispatched the patron will receive another SMS that the order is on its way. The SSSK will ensure that both the user in the library and the remote patron have access to the library services through the SSSK.

8 Conclusion

The study proposed a framework to provide information services through the SSSK so that patrons can access the library services without the help of a librarian. Through the SSSK the library services can also be accessed remotely. It is hoped that the framework will help in ensuring that through the SSSK, quality library services will be provided at the NUL Library. Patrons can then access books remotely through the use of an intelligent robotic machine and drones can deliver the books to and from the patron's location. For future focus, the researchers intend approaching other academic libraries to consider using a SSSK embedded in AI, an intelligent robotic machine, and drones to provide library services remotely. Once tested, other countries or universities in other countries can also consider using SSSKs to provide library services remotely.

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