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Internet of Things for archival ease of access to users in the Fifth Industrial Revolution

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Abstract

The prevalence of the internet of things has significantly contributed to streamlining archival access for users in the Fifth Industrial Revolution. The internet of things is characterised by physical objects equipped with sensors, processing capabilities, software and other technologies that facilitate data exchange with devices and systems over the internet or other communication networks. In the fifth industrial revolution, the internet of things can play a pivotal role in ensuring quick and efficient access to archival materials within archival institutions. The internet of things involves the use of intelligently connected devices and systems, utilising data collected by embedded sensors and actuators in physical objects. Technologies such as radio frequency identification, sensors, tags and AI-driven applications like the smart archival app can expedite the retrieval of archival records. This study sought to investigate the application of the internet of things to enhance archival access for users, employing content analysis to develop a framework for implementing the internet of things in archival settings. The findings indicate that utilising RFID, sensors and tags significantly accelerates access to archival records by efficiently tracking their location. This presents a promising solution for users who currently invest considerable time, money and effort to access required archival materials, often requiring visits to archival institutions. The study proposes a comprehensive framework for applying the internet of things to facilitate archival access for users in the Fifth Industrial Revolution. The hope is that this framework can serve as a valuable benchmark and guideline for implementing the internet of things in archival settings, offering efficient access to archival materials in the Fifth Industrial Revolution.

Keywords: internet of things, radio frequency identification device, archival records, archival records access, Fifth Industrial Revolution

Introduction

Amidst the fifth industrial revolution (5IR), the internet of things (IoT) emerges as a crucial tool for expediting access to archival materials within archival institutions. The IoT involves physical objects equipped with sensors, processing capabilities, artificial intelligence (AI) software, applications and other smart technologies, facilitating data exchange with intelligent devices and systems over the internet or other communication networks. Leveraging technologies like radio frequency identification (RFID), sensors, tag, and AI-assisted software applications can significantly enhance the quick access of archival records. In the 5IR, the integration of AI,

intelligent robotic machines, collaborative robots (cobots), cloud computing technology and IoT is pivotal for the effective management and accessibility of digital archives. This collective approach ensures that digital archives are efficiently managed and made readily available to the public through the utilisation of IoT (Bakogiannis, Mytillius, Doka & Goumas 2020). However, this study specifically concentrated on the use of the IoT for the rapid access and management of archival records, employing intelligent devices and networks. The concept of the 5IR emphasises the harmonious collaboration between human intelligence (HI) and AI, eliminating the competition between the two. In this paradigm, the strengths of AI and HI are combined to facilitate easy access to archival records in archival institutions (George & George 2020). For the IoT to effectively enable easy access, HI plays a crucial role in physically retrieving archives from shelves or searching for archival records via AI-assisted electronic records management systems and smart archival devices (Nel-Saunders, 2023).

Gil, Ferrandez, Mora-Mora and Peral (2016) conceptualises the term "internet of things" by breaking it down into two components for better comprehension: "internet", denoting multiple communication systems, and "thing", describing smart technologies. The IoT encompasses physical objects equipped with processing ability, RFID, sensors, intelligent software and other technologies, enabling them to connect and exchange data with other devices and systems over the internet or alternative communication networks. This concept extends to facilitating easy access to archival records within archival institutions (Gil et.al. 2016). Makka, Arora and Mopuru (2021) offer a complementary definition, characterising the IoT as a network comprising computing devices, mechanical and digital equipment that can autonomously share data through a network without requiring human interaction. Broadly, it refers to any object, person or machine connected via the internet to provide users with straightforward access to archival records.

The growth of IoT has given rise to numerous disruptive technologies and applications, including domains such as smart homes, autonomous vehicle fleets, health and well-being, personal and home security, and natural disaster management. Within these applications, the volume of IoT data, including sensor data generated by internet-connected devices, can become exceedingly large, involving billions of sensors across various fields, including archives and records management. Consequently, the efficient collection, storage and analysis of massive amounts of IoT data play a pivotal role in our contemporary information-based society, particularly in facilitating access to archival records (Giouroukis et al. 2019).

"Archival ease of access" refers to the level of convenience, efficiency and effectiveness with which users, researchers or archivists can retrieve and access archival materials within archival institutions. This concept encompasses various factors, including the accessibility of physical records, the organisation and retrieval systems in place, the integration of digital technologies and the overall user experience. In the context of archival management, achieving archival ease of access involves implementing strategies and technologies that streamline the process of locating, retrieving and using archival materials. This may include adopting digital cataloguing systems, implementing efficient record-keeping practices and leveraging emerging technologies such as the IoT, RFID and smart archival applications (Masenya 2020).
The concept IoT has been viewed as a misnomer because smart devices do not necessarily require a connection to the public internet; rather, they only need to be linked to a network and may be individually addressable for efficient management and access to archival records. The IoT involves

the use of intelligently connected devices and systems, harnessing data collected by embedded sensors and actuators in machines and other physical objects (Giouroukis et al. 2019). In essence, the IoT encompasses physical objects or groups of objects with sensors, processing capabilities, software and other intelligent technologies that facilitate data exchange with other devices and systems over the internet or alternative communication networks (Gil et al. 2016). Consequently, the IoT emerges as an evolving smart technology for the management of records and archives, constituting a dynamic and global network infrastructure where "things" communicate among themselves, interact with the environment, exchange data generated by sensing and respond to events by triggering actions to control the physical world (Martens, Da Silva, Silva & Martens 2022). Expanding on this concept, Martens et al. (2022) describes the IoT as the overarching idea of seamlessly integrating physical objects into the information network, making them readable, recognisable, locatable, addressable and controllable via the internet and data.

The management and preservation of archival records and archives pose considerable challenges, particularly for record management companies lacking proper intelligent systems and smart technologies. Preservation efforts entail inherent risks, such as mismanagement during relocation to offsite storage facilities, incorrect indexing and barcoding, potentially leading to permanent damage of archival records (Msomi, Kalusopa & Luthuli 2021). Bulk archival records management involves risks at various stages of the record's lifecycle. The IoT stands out as a significant driver of cloud storage, with demand rapidly increasing globally (Gadomski 2020). To mitigate the risks, the use of IoT-enabled systems is crucial. These systems grant archivists real-time access to organisational archival records and data management, ensuring efficiency and minimising errors. The implementation of IoT systems, coupled with robust security measures, assures reliable archival records and data management. In the field of archives and records management, IoT can expedite record location through RFID technology, tags, sensors and intelligent tracking devices. Additionally, IoT can safeguard records against unauthorised access using sensors and tags. Consequently, this study aims to explore the application of IoT for enhancing archival accessibility in the 5IR.

Problem statement

The problem that led to this study was the difficulty in accessing archival records stored in public archives in South Africa. This challenge arose from the prevailing technology disruptions caused by the proximity of users. In South Africa, public archives are predominantly managed manually, with manual systems implemented for archival access. Although some public archives have incorporated electronic records management systems, the lack of integration between electronic and manual systems poses a significant hurdle (Msomi et al. 2021). Consequently, users face challenges in retrieving and accessing archival materials due to mismanagement, misplacement and loss of materials. The existing systems also fail to accurately indicate the whereabouts of archival materials, making it difficult for users to locate specific items. The absence of tracking features in current records management systems exacerbates the problem when materials are

misfiled, requiring considerable effort to trace them. Moreover, users incur both financial and time costs when visiting archival institutions, particularly when access is limited to physical materials (Chigariro & Khumalo 2018).

The implementation of IoT ensures the seamless retrieval and access of archival records in public archives. Utilising a smart archival app, archival records can be tracked, allowing for their location even in instances of misfiling or loss, particularly within the archival custody. Archivists can employ tags, tracking devices, sensors and RFID technology to expedite the easy and quick retrieval and access of archival records. These records can be efficiently tracked through tags and the smart archival app, enabling the precise identification of their location within the archival institution (Qin 2018). The use of RFID, coupled with AI-aided electronic management systems, facilitates wireless communication with the actual archival records, even when they are in use outside of the archival institution (Tove & Kristian 2020). This integration enhances overall efficiency in archival record management, ensuring prompt and reliable access for both archivists and users.

Through tracking archival records via the smart archival app, archivists can determine the current custodian of the record and anticipate when it should be returned to archival custody. Upon its return, an automatic notification can be generated and sent to the requester, informing them that the record is back in archival custody (Giouroukis et al. 2019). This paper, therefore, explores the application of IoT to enhance ease of access to archival records for users in the 5IR. A framework is also recommended for how the IoT can be applied to provide archival ease of access to users in the 5IR.

Purpose of the study

The purpose of this study was to investigate the application of the IoT for archival ease of access to users in the 5IR.

Objective of the study

The following is the objective of the study:

- Evaluate the significance of IoT for archival ease of access to users in the 5IR.
- Identify the IoT devices that can be used to provide archival ease of access to users in the 5IR.
- Assess the challenges of using IoT to provide archival ease of access to users in the 5IR.
- Recommend a framework that can be used to apply the IoT for archival ease of access to users in the 5IR.

Literature review

The literature review of this study was based on the significance of the IoT to manage archival materials and the IoT devices that can be used to provide easy access to archival records, and the challenges thereof in the 5IR. According to Yusof et al. (2020), the IoT plays a crucial role in the

management and efficient provision of digital archives and records. The significance of the IoT in this context includes:

The IoT revolutionises archival management by providing dynamic real-time access to materials within archival institutions. Archivists can remotely monitor the location and status of all archival records and data, regardless of the storage location, through internet connectivity. This freedom from physical constraints means archivists can efficiently retrieve records from any location with internet access, enhancing flexibility and responsiveness (Masenya 2020). Moreover, the IoT introduces intelligent categorisation to archival records in custody. Archivists leverage continuous access to documents to provide users with an advanced classification system. Through the IoT, automated classification systems adeptly group similar archival records, presenting a cohesive and organised structure. This intelligent categorisation not only simplifies the archival management process, but also significantly enhances the user experience by facilitating quick and accurate retrieval of specific records within the archival institution (Dox & Box 2022).

The IoT also revolutionises the management of archival records within archival institutions, ensuring both efficiency and security. IoT-enabled services play a pivotal role in guaranteeing consistent risk-free and efficient management of archival records and data. Leveraging sensors, tags, tracking devices and RFID technology, the IoT provides robust protection against unauthorised access and retrieval of archival records. Additional security measures, such as biometric systems, encrypted passwords and codes further safeguard the integrity of the records and archives (Kumar, Tiwari & Zymbler 2019). Dox and Box 2022 opines that one of the notable advantages of the IoT in archival management is the elimination of manual labour. Unlike human intelligence (HI), the IoT enables quicker access to archival records, eliminating the potential for errors associated with manual processes. Archivists can use RFID and sensors within the archives to track and trace the archival records, alleviating the need for laborious manual efforts to locate and retrieve archival records from custody. The IoT significantly streamlines the retrieval and access processes by utilising tags and RFID technology to trace archival records efficiently. This not only enhances the speed of retrieval, but also contributes to a more organised archival environment. Furthermore, the IoT ensures secure storage of archival records, offering higher visibility and instant access. Cloud storage facilities play a pivotal role in this, providing unlimited storage capacity and enabling archival records to be accessed and retrieved from anywhere with internet and data access (Yusof et al. 2020).

According to Masenya (2020), a range of IoT devices can significantly contribute to facilitating easy access to archival records, including routers, sensors, tracking devices and RFID technology. Each of these devices plays a distinct role in enhancing the digital management of archival materials. A router, as highlighted by Masenya (2020), is a fundamental networking device responsible for forwarding data packets between computer networks. In the context of archival management, routers are essential components for organisations aiming to navigate the digital landscape effectively. They fulfil critical functions in directing traffic on the internet, ensuring seamless communication between various networks. Given that data in the digital format are transmitted in the form of packets, routers become indispensable for managing the flow of information. As organisations, particularly records management practitioners and archivists, transition to digital services, prioritising internet facilities, such as routers, becomes imperative (Hilbert 2013). These facilities not only enable organisations to participate in the digital sphere but

also ensure quick and uninterrupted access to archival records, transcending temporal and spatial constraints.

A sensor, in its basic definition, is a device designed to produce an output signal by detecting a physical phenomenon. Broadly encompassing various forms, a sensor can be a device, module, machine or subsystem that identifies events or alterations in its surroundings and transmits this information to other electronic components, typically a computer processor (Javaid, Haleem, Rab, Singh & Suman 2021). Importantly, embedded sensors extend beyond traditional mobile devices and are increasingly integrated into diverse locations and objects. In the field of archives and records management, the application of sensors is particularly promising. Embedded sensors, as noted by Yusof et al. (2020), have the capacity to detect and communicate changes across a myriad of locations and objects. This includes their utilisation for tracking records and archives within archival institutions. Leveraging the capabilities of sensors can be instrumental in developing efficient systems for managing archival materials. For instance, as highlighted by Yusof et al. (2020) and corroborated by AtlasRFIDstore (2022a), a smart archival app can be a powerful tool that incorporates embedded sensors. These sensors facilitate the quick tracing of records and archives, ensuring easy access and retrieval within the archival institution. The integration of sensor technology into archival management systems not only enhances the efficiency of tracking processes, but also contributes to the seamless organisation and accessibility of archival materials.

A tracking device, defined as an electronic or mechanical tool enabling remote determination or tracking of the position or movement of a person or object, serves as a valuable asset in the field of archival management (Boulos, Maged & Geoff 2012). This encompasses devices storing geographic or location data for subsequent access or analysis, allowing real-time monitoring of movement. In the field of archives and records management, tracking devices play a pivotal role in facilitating the monitoring and management of archival records. Archivists and records management practitioners can utilise tracking devices to monitor the whereabouts of archival records, whether they are in the possession of users and researchers or stored on archival shelves within the institution. The versatility of tracking devices allows for comprehensive oversight of archival materials, ensuring efficient management and access (Masenya 2020). Importantly, tracking devices provide a valuable solution for scenarios involving lost records. If the need arises to recover misplaced archival records, tracking devices can be employed to trace their location, regardless of where they may be situated. This capability becomes particularly crucial in maintaining the integrity of archival collections and ensuring that records are accounted for, which contributes to effective archival stewardship (Saheb, Cabanillas & Higueras 2022).

RFID technology uses radio waves to passively identify objects equipped with RFID tags. Widely employed in various commercial and industrial applications, from tracking items in supply chains to managing checked-out items in archives and records offices, RFID plays a pivotal role in modern information management (Bhise 2016). The technology relies on electromagnetic fields to automatically identify and track tags affixed to objects, typically comprising a radio transponder, a radio receiver and a transmitter. In the field of archives and records management, RFID serves as a crucial component in connecting IoT devices. This integration facilitates wireless communication between gadgets, creating a cohesive system that streamlines the location and easy access of archival records in archival custody. By incorporating RFID technology, archival institutions can achieve seamless and efficient retrieval and access to records and archives (Ajami

& Rajabzadeh 2013). Expanding on this, Yusof et al. (2020) propose the integration of image recognition devices, particularly within a 3D security gate, to enhance archival security and user validation. Image recognition technologies, designed to identify objects, people and buildings, can be instrumental in confirming whether the user accessing archival records is affiliated with the institution. Functioning as a 3D security system equipped with cameras, this technology identifies individuals passing through it and can scan for unauthorised removal of items, enhancing overall security measures within archival institutions (Yusof et al. 2020).

Despite the significant benefits, adopting and implementing the IoT for providing access to archival records comes with its own set of challenges. One of the primary concerns is security, as highlighted by Saheb et al. (2022). Digital archival records stored in cloud storage facilities or local servers are vulnerable to hacking, which raises serious security issues. Hackers may unlawfully gain access to these storage facilities, compromising the integrity and confidentiality of archival records. Privacy is another critical concern when using the IoT for easy access to archival records. If digital archival records lack adequate protection, such as encrypted passwords and security codes, they become susceptible to privacy breaches. Ensuring robust security measures is imperative to safeguard sensitive information contained in archival records. Moreover, the complexity of navigating archival records online through IoT devices poses a significant challenge, as noted by Kumar et al. (2019). The intricacies of the digital landscape may be overwhelming for users, potentially hindering the accessibility and user-friendliness of archival records. Overcoming this complexity requires user-friendly interfaces and effective training programmes to empower users in efficiently navigating and retrieving archival materials through IoT-enabled systems.

Research methodology

This qualitative study employed content analysis as its primary research methodology, drawing on both existing literature and the researchers' own experiences to explore the application of the IoT for enhancing archival ease of access in the 5IR. The research methodology involves an in-depth examination of relevant literature, with a particular focus on themes and keywords associated with the intersection of the 5IR, IoT, archival records and archival access. The literature review was informed by the collective knowledge and expertise of the researchers, providing valuable insights into the current landscape of IoT applications within archival contexts. Themes and keywords such as "fifth industrial revolution," "internet of things," "archival records", and "archival access" guide the exploration and analysis of pertinent literature.

To systematically navigate the extensive body of literature, the researchers relied on the use of keywords and themes to identify relevant sources. The primary search engine used was Google Scholar, a platform known for its extensive coverage of scholarly articles. Through this search engine, the researchers gained access to a myriad of literature sources, with thousands of outputs initially listed. The researchers then refined their search and meticulously selected literature that aligned with the study's objectives. The content analysis process involved the examination of selected literature to extract key insights, trends and findings related to the application of IoT for archival ease of access. The study's reliance on content analysis ensures a rigorous and systematic approach to synthesising knowledge from diverse sources. This research methodology integrates

content analysis with insights from existing literature and the researchers' experiences, providing a foundation for investigating the role of IoT in facilitating archival access in the 5IR.

Findings of the study

The IoT enables archival institutions to provide seamless access to archival records. RFID technology plays a pivotal role in this transformation, enabling smart technological devices to interconnect and communicate wirelessly, facilitating the tracking of archival records within the institution. This connectivity, orchestrated through routers, ensures that RFID, intelligent tracking devices, tags and sensors are seamlessly linked through the internet and data, thereby establishing a comprehensive network for easy and rapid access to archival records (Yusof et al. 2020). The integration of a smart archival app empowers archival users, allowing them to effortlessly access records on the shelves. Intelligent tracking devices and sensors, strategically deployed within the archives, contribute to the swift tracking and retrieval of archival materials. This not only enhances the user experience, but also streamlines the archival management processes (Dox & Box 2022). Furthermore, the IoT application allows archivists to remotely check the location and status of archives in any institution, offering real-time insights through the internet and data connectivity. Automated classification and shelving processes, facilitated by RFID, tags and sensors, ensure that archival records are systematically organised for quick and easy user access. While these advancements promise enhanced efficiency and accessibility, security and privacy concerns are paramount. When used for archival records, RFID, tags and sensors employ encryption with security codes and passwords to safeguard against unauthorised access. However, the literature emphasises the persisting challenges of security and privacy, with potential vulnerabilities that hackers may exploit, underscoring the need for continuous vigilance and robust cybersecurity measures (Ajami & Rajabzadeh, 2013; Kumar et al. 2019). The IoT's application in archival institutions brings about a paradigm shift, streamlining processes, enhancing accessibility and improving user experiences. However, the ongoing challenges of security and privacy require a proactive and vigilant approach to ensure the integrity and confidentiality of archival records in the digital era.

Recommendations

This section presents the framework proposed for the application of the IoT for easy archival access by users in the 5IR. The application of the IoT can benefit the public when accessing archival records, especially in public archives in the 5IR by using RFID, tags, intelligent tracking devices and sensors to trace the archival records, as recommended and presented in figure 1. The framework is discussed on the basis of the following: RFID, tags, sensors, intelligent tracking devices, intelligent 3D security gates and cloud-based Electronic Records Management System (ERMS), shelves for manual archival access using the IoT and smart computer technology, and cloud computing technology, especially for electronic archival access through the use of the IoT devices.

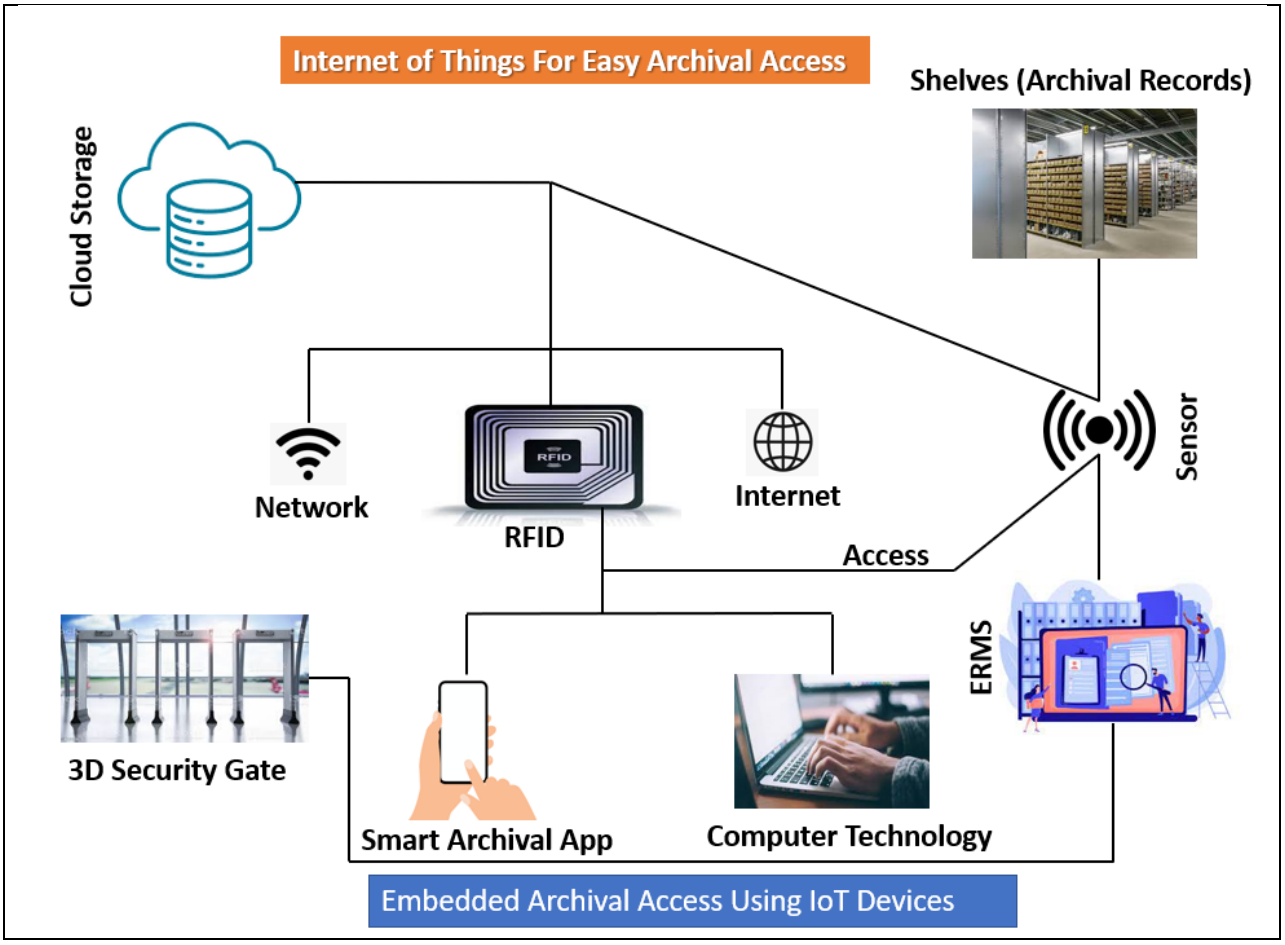

Figure 1: Framework to apply the internet of things for archival ease of access in the fifth industrial revolution

This framework revolves around embedded archival access using IoT devices, with a focus on user-friendly functionalities facilitated by a smart archival app. Users can employ the app to search and browse archival records within specific archival institutions, determining availability and precise locations. Once identified, users can seamlessly trace desired archival records using the smart archival app, guided to the exact location through sensors and RFID technology within the archival institution. The smart archival app not only streamlines the retrieval process, but also allows users to independently check out archival records without archivist assistance. Through RFID, the user's record in the database is promptly updated, indicating the check-out or check-in of a particular archival record. This feature enhances the overall effectiveness of archival record management and retrieval. Furthermore, the integration of RFID, tags and sensors enables archival records to be desensitised, permitting them to pass through a 3D security gate. This becomes particularly relevant if users intend to use archival records outside the archival institution, adhering to institutional policies that dictate whether users are allowed to take records offsite.

Users can seamlessly access the smart archival app through smart computer technology, unlocking a gateway to archival records preserved in cloud storage facilities. This integration allows users to

navigate and retrieve archival records effortlessly through an AI-embedded ERMS linked with the smart archival app, ensuring quick and convenient access. Utilising RFID technology, archival records can be efficiently traced and accessed directly from the cloud storage facilities of archival institutions. Once accessed, users have the flexibility to print archival records, send them to their email or preserve them locally on personal servers such as smartphones or laptops. This process leverages the internet and data to establish seamless interconnection and communication between smart technological devices, including smart computer technology, RFID, sensors and intelligent tracking devices. This interconnected network ensures easy and widespread access to archival materials for the public. To fortify the security of archival records, measures such as encrypting records with security codes and passwords are implemented. Archival records stored in cloud storage facilities are safeguarded against unauthorised access, adding an extra layer of protection to valuable historical materials. Embedded access to archival records through this IoT-driven framework not only provides convenience, but also serves as a cost-effective solution, sparing users the need for physical travel and associated expenses. This virtual accessibility aligns with the evolving landscape of technological advancements, offering users a practical and efficient means to engage with archival materials. Therefore, the embedded archival access framework, driven by IoT devices and the smart archival app, empowers users to seamlessly navigate archival records, check them out independently and adhere to security measures defined by institutional policies. This approach not only enhances user autonomy, but also contributes to the effective management and retrieval of archival materials within the evolving landscape of archival institutions.

Conclusion

This study proposes a comprehensive framework leveraging the IoT to enhance archival ease of access for users within the 5IR. The IoT components, including RFID, tags, sensors and intelligent tracking devices, are integrated to facilitate a seamless and efficient retrieval process for archival records within archival institutions. The primary objective of this framework is to not only expedite the accessibility of archival records, but also fortify their security against unauthorised access. Security measures, such as encrypted passwords and security codes, are embedded to safeguard the integrity and confidentiality of archival materials. The proposed framework introduces the use of a smart archival app, empowering users to trace and locate archival records within an archival institution. This user-friendly interface streamlines the retrieval process, offering a quick and intuitive method for accessing historical materials. Additionally, the integration of smart computer technology allows users to retrieve digital archives stored in cloud storage facilities, irrespective of time and location. As part of the future focus, the researchers aimed to collaborate with national and provincial archives to encourage the adoption of IoT technologies for accessing and securing archival materials in the 5IR. This collaborative approach sought to test the viability and efficacy of the proposed framework in diverse archival settings. Following successful implementation in public archives, the framework could be extended to private archives, encouraging the widespread adoption of IoT-driven tools such as the smart archival app, intelligent tracking devices and sensors for archival ease of access in the 5IR. This holistic approach envisions a technologically advanced archival landscape that maximises efficiency, accessibility and security for both archivists and users alike.

References

Ajami, S. & Rajabzadeh, A. 2013. Radio frequency identification (RFID) technology and patient safety. *Journal of Research in Medical Sciences* 18(9): 809-813.

AtlasRFIDstore. 2022a. *Three reasons your company needs an RFID file tracking system*. [Online]: https://www.atlasrfidstore.com/rfid-insider/three-reasons-rfid-file-tracking-system (Accessed 20 October 2022).

AtlasRFIDstore. 2022b. *RFID file tracking and management*. [Online]: https://www.atlasrfidstore.com/rfid-file-tracking (Accessed 20 October 2022).

Bakogiannis, T., Mytillius, L., Doka, K. & Goumas, G. 2020. Leveraging blockchain technology to break the cloud computing market monopoly. *Computer* 9(1): 1-9.

Bhise, K.S. 2016. Wildlife animals tracking using RFID and GSM technology. International *Journal of Scientific and Engineering Research* 7: 1-2.

Boulos, K., Maged, N. & Geoff, B. 2012. Real-time locating systems (RTLS) in healthcare: A condensed primer. *International Journal of Health Geographics* 11(1): 11-25.

Chigariro, D. & Khumalo, N.B. 2018. Electronic records management research in ESARBICA: A bibliometric study. *Records Management Journal* 28(2): 159-174.

Dox and Box. 2022. *IoT enabled systems*. [Online]: https://www.doxandbox.com/iot-enabled (Accessed 20 October 2022).

Gadomski, R. 2020. IoT and AI generated demand for active archives. [Online]: https://datastorage-na.fujifilm.com/iot-and-ai-generate-demand-for-active-archive/ (Accessed 3 May 2023).

George, A.S. & George, A.S.H. 2020. Industrial revolution 5.0: The transformation of the modern manufacturing process to enable man and machine to work hand in hand. *Seybold Report* 15(9): 214-234.

Gil, D., Ferrandez, A., Mora-Mora, H & Pearl, J. 2016. Internet of things: a review surveys based on context aware intelligent services. *Sensors,* 16(7):1-23.

Giouroukis, D., Hülsmann, J., Von Bleichert, J., Geldenhuys, M., Stullich., T., Gutierrez, FO., Traub, J., Beedkar, K. & Markl, V. 2019. Resense: transparent records and replay of senor data on the internet of things. Published in Proceedings of the 22nd International Conference on Extending Database Technology (EDBT), 26-29 March 2019.

Hilbert, M. 2013. Technological information inequality as an incessantly moving target: The redistribution of information and communication capacities between 1986 and 2010. *Journal of the Association for Information Science and Technology* 65(4): 821-835.

Javaid, M., Hleem, A., Rab, S., Singh, R.P. & Suman, R. 2021. Sensors for daily life: A review. *Sensors international* 2:1-10.

Kumar, S., Tiwari, P. & Zymbler, M. 2019. Internet of things is a revolutionary approach for future technology enhancement: A review. *Journal of Big Data* 6(1110): 1-21.

Makka, S., Arora, G. & Mopuru, B. 2021. IoT based health monitoring and record management using distributed ledger. *Journal of Physics: Conference Series* 2089: 012030. [Online]: https://iopscience.iop.org/article/10.1088/1742-6596/2089/1/012030/pdf (Accessed 20 May 2023).

Martens, C.D.P., Da Silva, L.F., Silva, D.F & Martens, M.L. 2022. Challenges in the implementation of internet of things projects and actions to overcome them. *Technovation*, 118: 102427.

Masenya, T.M. 2020. Application of modern technologies in the management of records in public libraries. *Journal of the South African Society of Archivists* 53: 65-79.

Msomi, M., Kalusopa, T. & Luthuli, L.P. 2021. Change management in the implementation of electronic health records (EHR) systems at Inkosi Albert Luthuli Central Hospital, South Africa. *South African Journal of Libraries and Information Science* 87(2): 1-10.

Nel-Saunders, D. 2023. *Revolutionizing public private partnerships: A transition to the Fifth Industrial Revolution*. School of Public Management, Governance and Public Policy: South Africa.

Saheb, T., Cabanillas, F.J.L. & Higueras, E. 2022. The risks and benefits of internet of things (IoT) and their influence on smartwatch use. *Spanish Journal of Marketing-ESIC* 26(3): 309-324.

Yusof, A.D., Hussin, N., Azman, K.A., Amran, N., Daud, S.C. & Tarmuchi, N.R. 2020. The internet of things (IoT): Impacts on information management field. *International Journal of Academic Research in Business and Social Sciences* 10(11): 1208-1216.