їх на 3D-моделі; Polycam — додаток пропонує розширений інструментарій, за допомогою фотографії чи відео дозволяє перетворити опрацьований об'єкт на 3D-модель.

Отже, оскільки традиційні інформаційно-комунікаційні установи мають досить невеликий бюджет (і не завжди мають можливість виграти грантові кошти для своїх потреб), то як перший крок для віртуалізації власних колекцій можуть використовувати мобільні додатки, а надалі популяризувати свої унікальні колекції у віртуальному середовищі.

O. Borysov

OPTIMIZING IOT INTEGRATION IN LIBRARIES: COMPARATIVE EVALUATION OF WIRED AND WIRELESS NETWORK SOLUTIONS

О. Борисов

ОПТИМІЗАЦІЯ ІНТЕГРАЦІЇ IOT У БІБЛІОТЕКАХ: ПОРІВНЯЛЬНА ОЦІНКА ДРОТОВИХ ТА БЕЗДРОТОВИХ МЕРЕЖЕВИХ РІШЕНЬ

A critical step in selecting the best solutions for integrating Internet of Things (IoT) systems into library processes is a comparative analysis of standards, protocols, hardware, and software technical characteristics. This method enables an extensive study of several alternatives for selecting the most appropriate solutions according to specific project requirements, such as performance, energy efficiency, security, scalability, and compatibility.

The goal is to choose only standards, protocols, and technological solutions that organically match each other and can be integrated into a library's infrastructure, whether they are being implemented new or already in place. It allows libraries to create a flexible and adaptable system to changing project requirements or operational conditions.

Wired and wireless networks' technical characteristics are not the only factors to be considered in organizing network information exchange in IoT-driven library projects; it is also essential to consider how to get good results by combining two types of networks. It is worth relying on several vital factors to make a reasonable choice between wired and wireless technologies: connection stability, energy consumption, security, integration potential with other systems, and data transmission speed. Today's gateways offer a means to reconcile disparate standards, enabling libraries to take advantage of the strengths of both network types in a unified infrastructure.

Wired networks provide stable, high-speed data transmission, which is particularly important in library environments where continuous, reliable access to servers and network resources is essential. Being immune to interference and having higher levels of security, these systems have become the best options for systems that must protect the data. However, wired solutions are challenging to install in historic library buildings, where cable routing can be expensive.

However, wireless networks are more flexible and more accessible to expand than that because the devices can connect without physical network attachment. Wireless options are perfect for mobile and distributed systems where devices must be rapidly reorganized into the network or new devices added. However, wireless networks may be unstable in complex environments where interference is a factor and consumes more energy, an essential consideration in some library projects.

Networking wired and wireless networks can leverage each other's strengths to build more flexible and scalable systems. It integrates different standards and protocols; thus, devices with different characteristics can be used in the same network. With wired networks, high-speed connections might be handled in addition to providing PoE (Power over Ethernet) power delivery. In contrast, wireless networks may support mobile user devices or IoT devices in scenarios where wired connections are impossible.

With the popularity of portable devices and the need to support user mobility, wireless technologies have been analyzed in particular. In this case, paying more attention to IEEE 802.11 standards is necessary as they are the basis of Wi-Fi networks worldwide. These standards are constantly changing dramatically, becoming faster, more secure, and more efficient in spectrum use with every revision. It allows libraries to select the best options for their environment.

Technical characteristics, energy consumption, cost, and network topology of each wireless technology used by sensors and actuators in IoT systems should be considered when analyzing the wireless technologies. It is essential in libraries, where energy efficiency and cost-effectiveness can be make-or-break factors.

In order to automate tasks, enhance user services, and optimize resource management, IoT technology integration into library processes can be effective. To be implemented successfully, the technologies relevant to library requirements and compatible with the existing infrastructure should be chosen. Table 1 compares the most common wireless technologies in terms of their fundamental properties.

Table 1

Wireless IoT standards comparison

Parameter	**Bluetooth Low Energy (BLE)**	**Wi-Fi**	**Z-Wave**	**IEEE 802.15.4 (Zigbee, Thread)**	**LoRaWAN**	**NB-IoT**
Range	10–1500 m	15–100 m	30–50 m	30–100 m	2–20 km	1–10 km
Bandwidth	up to 2 Mbps	up to 1.3 Gbps	up to 100 kbps	up to 250 kbps	up to 50 kbps	up to 200 kbps
Power consumption	Low	Medium	Low	Low	Low	Low
Maintenance costs	One-time			Recurring		
Module cost	< $5	< $10	< $10	$8–$15	$8–$15	$8–$20

It is possible to get flexibility, reliability, and system security using modern gateways, selecting equipment carefully, and combining wired and wireless networks. This approach makes library operations efficient and allows libraries to continue adapting to new technological challenges while maintaining investments in existing infrastructure.

Bluetooth Low Energy (BLE) technology in library environments for indoor navigation systems and equipment tracking is possible as BLE technology is low-power and cost-efficient. High-speed data transfer to users with portable devices and some IoT equipment continues to rely on Wi-Fi as the primary wireless access method.

Z-Wave and Zigbee/Thread-type technologies are great for creating low-power networks that can automate such library processes as lighting, climate control, and security. On the other hand, LoRaWAN is good at collecting data from distributed, remote

sensors or monitoring the library's exterior due to its relatively long range and low energy consumption.

IEEE 802.3, which everybody knows as Ethernet, is the standard for libraries for establishing local area networks. This standard was initially developed in the 1980s, has evolved considerably, and has become widely adopted because of its flexibility and ability to accommodate the growing requirements of networking technologies. Ethernet is the backbone of most modern computer networks, providing reliable, stable, high-speed data transmission between devices. It is the preferred option for setting up network infrastructure in most libraries. Different revisions of the IEEE 802.3 standard provide different network characteristics, including data transmission speeds, node distances, and cable types, which keep Ethernet relevant in the fast-changing tech landscape.

The lack of a pre-defined infrastructure allows libraries to explore a large number of possible solutions and choose the best tools for a particular task. A comprehensive analysis will enable libraries to make intelligent decisions based on their unique operating conditions, provided that such factors as data transfer speeds, signal range, reliability, and ability to withstand interference in a crowded wireless environment.

Taking into account the preponderance of the existing infrastructure, it is essential to pay special attention to implementing these technologies in library processes. IoT technologies can be integrated with library operations to automate tasks, support better service to users, and better manage resources. To become and stay successful, the technologies used must support the requirements of the library and be compatible with the existing infrastructure.

Combining wired and wireless networks, using modern gateways, and choosing the right equipment make the system flexible, reliable, and secure. It facilitates the effective execution of library processes and enables library adaptation to new technological solutions while protecting prior investments in infrastructure.

Д. Гончаров

СТАН ГОТОВНОСТІ УКРАЇНСЬКИХ БІБЛІОТЕК ДО ВПРОВАДЖЕННЯ ТЕХНОЛОГІЙ ШТУЧНОГО ІНТЕЛЕКТУ: МЕТОДОЛОГІЯ СОЦІОЛОГІЧНОГО ДОСЛІДЖЕННЯ

D. Honcharov

READINESS OF UKRAINIAN LIBRARIES FOR IMPLEMENTING ARTIFICIAL INTELLIGENCE TECHNOLOGIES: SOCIOLOGICAL RESEARCH METHODOLOGY

Штучний інтелект (ШІ) стає невіддільною частиною життя людей і бібліотеки починають його впровадження у свою роботу. Швидкість розвитку технологій ШІ призводить до того, що в Україні не існує актуальної предметної бази знань та перевірених практичних рекомендацій щодо цього питання. Рушійною силою вивчення ШІ є розвиток генеративних моделей, таких як ChatGPT та Stable Diffusion. Легкість використання цих технологій зумовлює низький поріг входу, а їх популярність підвищує бажання спробувати. Важливо виділити різні ролі бібліотекарів-практиків та бібліотекознавців, оскільки від цього безпосередньо залежить мотивація використання ШІ: практики зацікавлені в автоматизації щоденних шаблонних завдань; вчені вивчають теоретичні можливості покращення різних сервісів і створюють нові концептуальні моделі; керівники бібліотек можуть