wjert, 2025, Vol. 11 Issue 4, 120-126.

Review Article

ISSN 2454-695X

World Journal of Engineering Research and Technology

WJERT

www.wjert.org

SJIF Impact Factor: 7.029

UTILIZING INTERNET OF THINGS AND ARTIFICIAL INTELLIGENCE FOR FREQUENCY IDENTIFICATION

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Article Received on 01/02/2025 **Article Revised on 02/03/2025** **Article Accepted on 22/03/2025**

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ABSTRACT

With the rapid advancement of detection systems, wireless transmission technology, and increasingly powerful chips, the application scope of the Internet of Things (IoT) has expanded significantly and swiftly, alongside research and development that incorporates artificial intelligence. Concurrently, the development of campus applications, which serves as the foundation for intelligent education, is progressing, necessitating support from emerging computer technologies such as IoT, machine learning, and big data. This study presents an architecture for a smart campus based on Radio Frequency Identification (RFID), which can provide innovative solutions to various challenges such as location tracking, identification, and data storage, owing to its robust anti- interference capabilities and non-intrusive nature, making it a core technology of IoT. Building on this architecture, a smart campus application system design is proposed, enabling functionalities such as automatic identity recognition, resource booking, internal consumption tracking, and student positioning. Furthermore, to address specific location requirements, this paper introduces a method for accurately determining the location of RFID tags based on the triangulation principle, which is integrated into the architecture. The implementation of IoT technology can significantly enhance initial or organizational efficiency, providing more effective support for educators and improving the work, study, and life experiences of students.

KEYWORDS: Internet of Things, Smart campus, RFID, Sensor technology, Anti interference, Capacity, Non-meddling.

1. INTRODUCTION

Since IBM introduced the concept of a "brilliant planet" in 2018, advanced educational environments in China have been developing, extending from universities to secondary and even primary schools. The rapid advancement of modern communication technologies and the swift progress in computer-related hardware have accelerated the growth of university data systems. Currently, various large-scale digital campuses have been established, facilitating the integration of information resources, electronic payment systems, and financial management frameworks, thereby enhancing the efficiency of operations, studies, and daily life for both educators and students. For example, the implementation of the Campus IC card system has provided students with a convenient means for dining, shopping, and accessing library services. The concept of context awareness was first introduced by Schilit and Theimer in 1994.

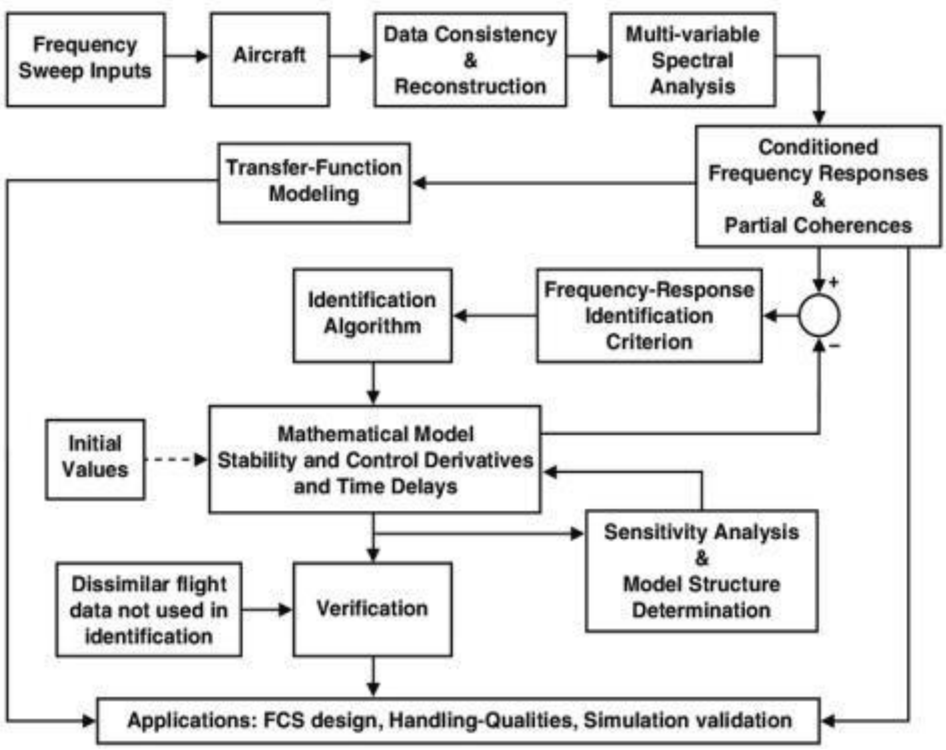

Figure 1: Frequency Identification using IoT and AI.

As exploration progressed, Dey introduced the concept of versatility (Dey, et al. 1998).[3,4] Salber offered an alternative definition (Salber, et al. 1998).[5] Dey and Abowd further advanced the application of context awareness (Dey, et al. 1999).[6] Tewari developed a comprehensive intelligent decision support system.

2. Definition of the Internet of Things

The Internet of Things (IoT) represents a crucial component of the new era of information technology. The term itself, "Internet+", suggests that the Internet of Things can be understood as "physical objects connected to the Internet." Fundamentally, the IoT is built upon the Internet, serving as an extension and evolution of the network based on web technology. Additionally, its user interface expands to encompass any object capable of engaging in data exchange and communication. The Internet of Things is an integrated application that relies on intelligent sensing, recognition technology, and pervasive computing, marking the third wave of development in the information industry, following the computer and the Internet. The IoT signifies the advancement of application development within the Internet framework.

2.1. Connectivity

Connectivity serves as the foundation of the Internet of Things. Whether through wireless, wired, or sensing technologies, objects must exhibit a state of "connection." The International Telecommunications Union posits that the connectivity of the Internet of Things encompasses four dimensions: firstly, it should enable connections at any time; secondly, it should facilitate connections in any location; thirdly, it should allow for connections with any object; and fourthly, it should enable connections with any individual.

2.2. Physical Object Connections

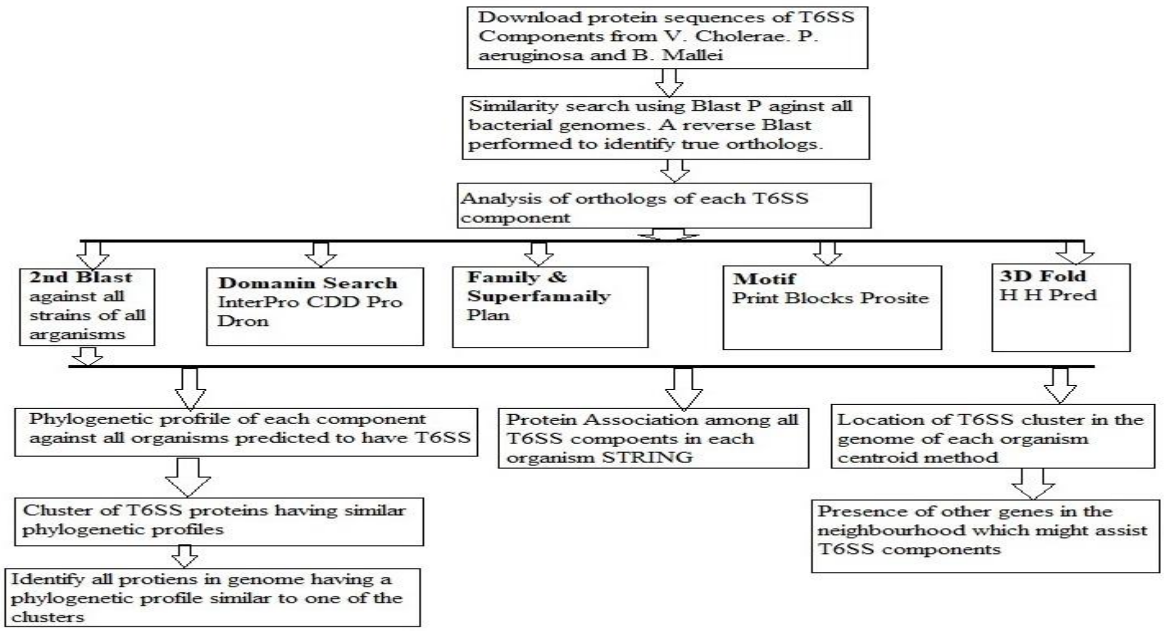

Figure 2: Frequency Identification using Internet of Things and Artificial Intelligence Block Diagram.

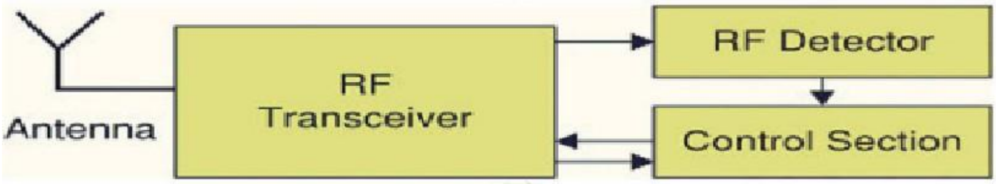

Figure 3: Frequency Identification using IoT and AI Process.

3. INTELLIGENCE

Intelligence refers to the comprehensive management of various items through the application of computer technology, sensor technology, control technology, and intelligent monitoring systems. From this perspective, the Internet plays a crucial role in the Internet of Things (IoT), enabling products around the globe to be interconnected not only through sensing methods but also through intelligent means. The IoT possesses smart perception capabilities, allowing it to monitor environmental conditions and enhance human understanding of resource utilization, leading to more informed decision-making. Consequently, the Internet of Things has found extensive applications across various sectors, contributing to the development of an industrial chain. Currently, several educational institutions in China have established programs focused on the Internet of Things and have conducted research on intelligent sensor networks, laying the groundwork for the further advancement of IoT technology.

4. Requirements

The analysis of the Smart Campus Internet of Things industry chain can be categorized into four key components: identification, perception, information processing, and transmission. The essential technologies associated with each component include RFID, sensors, smart chips, and the wireless transmission networks utilized by remote service providers.

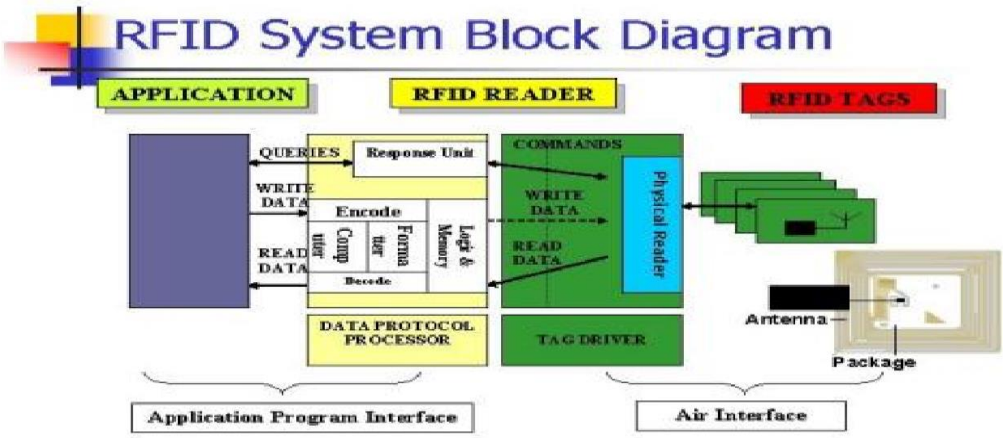

Figure 4: Frequency Identification using IoT and AI date proc.

The establishment of the domestic Internet of Things (IoT) industry faced significant challenges, particularly in terms of key connections and normalization efforts, which were largely ineffective. In response, the public organization initiated research and development projects focused on IoT technology and its industrialization. This included the launch of a national networking application demonstration project aimed at promoting the development and industrialization of essential technologies, standard frameworks, and public service platforms. The initiative emphasized advancements in core technologies and the enhancement of the industrial chain to provide effective support for the application of critical areas within the Internet of Things.

5. Methodology

This paper proposes a design scheme for an intelligent campus management system, grounded in the fundamental principle of effectively integrating various functions of a digital campus while prioritizing user convenience. Leveraging Internet of Things technology, the system is designed to facilitate user management, automatic identification, library borrowing, internal consumption, and student information management, among other functionalities.

6. Architecture

To meet the requirements for automatic identification and the integration and sharing of application data among teachers and students in the context of an intelligent digital campus, the IoT-based intelligent digital campus employs a three-tier architecture. This architecture, illustrated in Figure 2, consists of the application data service layer, the network communication layer, and the terminal user layer.

7. System Function Module

The intelligent digital campus system, which is founded on a unified user identity recognition mechanism, primarily comprises four functional modules: user identity management, conference management, student attendance management, and school vehicle management. The user identity management module employs sensing and RFID technologies to monitor personnel access in critical areas such as libraries. Additionally, it features a recording capability that tracks the number of individuals and the duration of their stay based on signal data. The school vehicle management module utilizes RFID technology to facilitate the swift, real-time, and precise collection and processing of information. This module serves as an enhancement and complement to traditional vehicle management methods, aligning with the needs of intelligent campus vehicle oversight.

8. CONCLUSION

The smart campus leverages the Internet of Things to provide advanced services and management capabilities. It enables the interconnection of individuals, objects, information carriers, and locations at any time and place. Furthermore, the aggregation of extensive data on the Internet of Things platform offers innovative business and service models for educators and students alike. While the smart campus undoubtedly enhances convenience for both teachers and students, it also encounters several challenges. A primary concern is the cost associated with establishing a smart campus, which necessitates a cohesive infrastructure platform that includes comprehensive wired and wireless network coverage.

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