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A Communication Application Design Framework based on Mesh Network Architecture for Folk Song Dissemination

Xin Liu[1*], and Anqi Tang[2]

[1*]DFA Candidate, Doctor of Fine Arts Program in Musicology, International College, Krirk University, Bangkok, Thailand. liuxinwddmps2022@outlook.com, https://orcid.org/0009-0004-1471-2209

[2]Professor, Doctor of Fine Arts Program in Musicology, International College, Krirk University, Bangkok, Thailand. titi.musictang@gmail.com, https://orcid.org/0000-0002-7664-1942

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Abstract

The swift advancement of the country's maritime industry has led to an escalating demand for marine space and resources, causing significant harm to the marine biological ecosystem. This study examines the legal framework for marine biological preservation, focusing on the context of wireless network (WN) data fusion to safeguard marine ecosystems and enhance the long-term sustainability of marine ecosystems. By examining the current conditions of various prominent marine locations and environmental settings in China, establishing a WN exchange device, incorporating WN information into marine sustainable assessments, gathering information via WN nodes, and contrasting WN data combined with conventional techniques, the effectiveness of marine conservation efforts and the detection of marine pollution techniques across different timeframes can be aligned with rapid economic growth to foster an ecologically sound aquatic ecology. The findings from the research indicated that surveillance efficiency via WN data fusion exceeds traditional methods by over 25%, and identification efficiency after three months remains more than 20% superior to the conventional approach. Data fusing in WNs significantly establishes a legal framework for marine biological and environmental safeguards.

Keywords: Digital Protection, Wireless Network, Marine, Ecology.

1 Introduction

Digital protection methods often encompass data fusion technological advances underpinned by encryption of information and information integration security focused on data integrity (Liu et al., 2022). According to specific criteria, data fusion oversees the data obtained from digital collecting units via their computers, synthesizes it across many dimensions, and derives relevant analytical insights to access

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*Corresponding author: DFA Candidate, Doctor of Fine Arts Program in Musicology, International College, Krirk University, Bangkok, Thailand.

the intended messages efficiently. This knowledge is precisely what individuals require in a complex informational landscape, eliminating superfluous, contradictory, and erroneous data, thereby enabling accurate predictions of future events and enhancing comprehension and foresight. It is highly advantageous to implement preventive measures in advance.

While the ocean remains steady, its currents are in motion. When an individual becomes sick in one location, the contamination will disseminate to other areas via water movement. A significant portion of maritime pollution originates from terrestrial sources, complicating the identification of offenders and liable parties for marine restoration efforts (Laine et al., 2021). Several municipal administrations are determined to pursue economic growth while disregarding the preservation of maritime habitats. They neither encourage ocean ecological conservation nor do they support the preservation of the marine ecosystem. In modern civilization, environmental management and ecological conservation are imperative for all humanity (Rehman et al., 2021). The problem of environmental compensation has garnered significant attention from policymakers and researchers. Establishing an effective marine environment preservation compensation scheme is a global trend (Liu et al., 2021).

The Wireless Network (WN) is a pioneering research domain with significant multidisciplinary and integrated expertise. It incorporates sensors, integrating computing technology, wireless communication, the internet, distributed networks, and data technology for processing (Ali et al., 2020). It can see, detect, and gather data from diverse settings using integrated micro-sensors or track things in real time. The data is sent electronically to the consumer's terminal within the self-packet multihop system. A sensor network comprises several microsensor units strategically arranged within a designated region, each equipped with computing and transmission via wireless capability (Pagonis, 2024). It can gather environmental data, generate reports, and transmit them to distant data-gathering sites. The data collecting point gathers and analyzes reports to determine the occurrence of accidents in the vicinity.

This report is innovative as it finalizes existing research on the relationship between coastal assets and industrial development by experts in China, using data from a WN and establishing a solid platform for future investigations. The impaired marine resources and issues in aquatic ecology during China's economic boom are evaluated, along with proposed resolution plans and methodologies. Research indicates that pollutants can be regulated, governmental oversight can be enhanced, and the appropriate laws and regulations are refined. It addresses current marine resource issues, facilitates fast economic development, and establishes an environmentally friendly marine ecosystem.

2 Related Works

By executing the eavesdropping attack, the opponent can likely pinpoint the vicinity of the source. Research suggested an anonymous cloud to safeguard the privacy of the original location (Almusaylim & Jhanjhi, 2020). The above cloud was formed by several nodes, resulting in its uneven shape. Numerous counterfeit packets were produced at the cloud's perimeter to obscure the transfer of source

information. The source frames were segmented and sent to the sink (Corrigan et al., 2023). Once the sink had sufficient components, the source packages could be reorganized.

Ma et al. employed obscurity to safeguard the privacy of the source address (Ma et al., 2020). The onion-based routing technique was chosen as the secret way to protect the source vehicle and its final location. The confidentiality of the origin, destination, and route was preserved throughout the execution of the plan.

In addition to the routing approaches, Zhao et al. safeguarded the source location's confidentiality from the adversarial viewpoint (Zhao et al., 2022). Their technique had two components: privacy prediction and phony packet sequencing. The privacy estimator determined the probability of data leakage depending upon the adversary's position, which was determined through communication between stations and adjacent ones. Counterfeit frames were introduced to divert the adversary's focus and safeguard the passage of the source package.

In addition, considering the imminent underwater placement of consumers, Jiang et al. presented a novel confidentiality of location strategy (Jiang et al., 2021). The positional interaction typically included the user's position; hence, the investigators proposed node collaboration to thwart adversarial packet interception. The undersea semantic position theory was employed to augment the confidentiality of information and increase the complexity of data packet decryption (Tran et al., 2021).

In recent years, with the in-depth research of relevant scientific research institutions, experts and scholars, and commercial organizations at home and abroad in the field of Augmented Reality (AR) and the continuous improvement of computer hardware and software performance, the application of AR has gradually moved from the laboratory to the public. Related supporting technologies have steadily developed and matured. It provides a robust technical guarantee for AR to implement digital development practices in cultural heritage (Hsieh, 2021). AR and related supporting technologies mainly include 3D tracking registration technology, display technology, interaction technology, virtual field rendering and rendering technology, network communication technology, cloud storage service technology, and so on (Laera et al., 2020). The development of display technology has made the application and experience of AR systems more convenient. From the early helmet display to the current media tablet display, smartphone display, and micro-projection display technology, It is possible to realize the essential digital experience, complete interpretation, digital display, and digital dissemination for spiritual life, convenience, and wide range.

The development of interactive technology enables digital cultural content to obtain multi-sensory and multi-dimensional digital entertainment experience, and modern interactive technology allows artistic content to solve the current practical problems such as "invisible, touching and experiencing" (Templin et al., 2022). In the process of experience, the position and orientation changes of the experience and the natural environment can be obtained through the movement of the camera and the tracking image in the natural environment (such as the change of the image landscape and the

transformation of the Angle rotation, etc.) (Fiorentino et al., 2021). According to the changes in these perspectives, the distance and orientation of virtual objects superimposed on the actual scene are correspondingly changed, which is one of the most basic interaction techniques in experience (Van den Oever et al., 2024).

The study indicates substantial opportunities for more research in undersea source location confidentiality, which started around a decade ago. Recent research has sought to confirm the practicality of partial position confidentiality technologies for undersea use, with techniques such as pseudo-information technology and multi-path technologies proving beneficial in specific contexts. Utilizing WN complicates tracking actions back to an opponent. Using the methodologies above, the research establishes the source position confidentiality safeguard procedure as a game involving a source and an opponent. A source employs an identity security strategy to evade an opponent while the adversary endeavors to intercept the source's data. The research analyzes the competition to identify the equilibrium between an attacker and a competitor.

3 Methodology

A substantial quantity of sensor nodes scattered across the observation region of a random WN establishes a structure by autonomy for tracking targets. The camera nodes independently preprocess the detected data before transmitting it to the aggregating node via adjacent nodes, which then interfaces with the outside web as a WN. The faraway base station acquires data from the sinking node and relays it to the distant database via the peripheral connection.

Upon processing, the data is disseminated to clients via various display functionalities. Meanwhile, customers can exchange data with aggregate nodes via the peripheral system, transmitting command and query requests to the sensors and receiving tracking data regarding the destination from the nodes. Figure 1 illustrates the configuration of the WN.

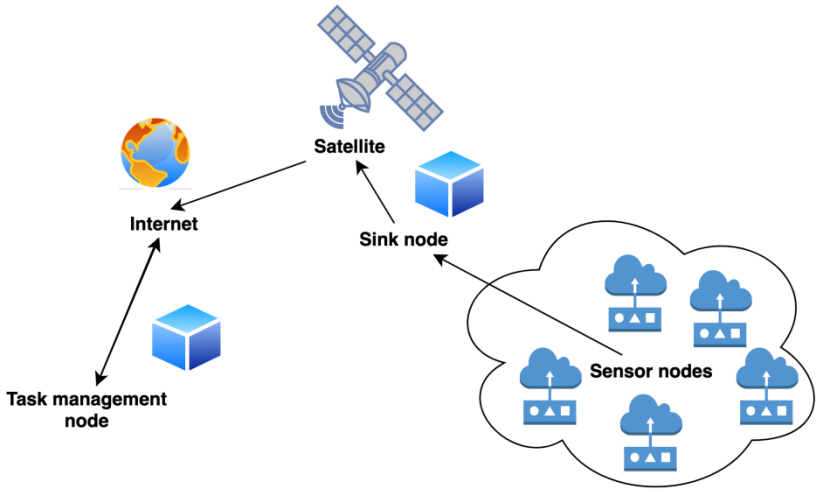

Figure 1: WN Architecture

All sensors inside the WN are equipped with integrated processors and memory, possess computational capabilities, and can execute specific data processing tasks. Nevertheless, due to the embedded processor's constrained computational capability and memory storage space, programs require judicious utilization of several sensors with restricted computing capabilities for collective dispersed data processing. The state of the workforce and the environment is fundamental to growth in society and economy, as well as ecological utilization and conservation.

The advancement of society and revenue growth can only be expedited and enhanced via the sustainable development of assets, the natural and social surroundings, and the entire ecosystem, ultimately aiming to preserve resources and their surroundings. When the strain of financial and social growth on the support system goes beyond its threshold, it will adversely affect and constrain the long-term growth of the socio-economic framework. Scientific and technical approaches can be employed to enhance the development of the economy. Strengthening the ability to carry cargo allows economic expansion to influence the marine environment positively. While these techniques enhance carrying capacity, such improvements must be constrained by the durability of a healthy system; alternatively, the environment's total capacity for transport would be compromised, rendering energy production unsustainable.

The concept of load capacity originated from its practical use, and several researchers have sought to evolve it from a fixed value to a relative one. The aggregate corpus of knowledge is expanding and enhancing. In short, the advancement of transferability theory enterprises relies on the contributions of several eminent figures, including the evolution of the ecology theory, the economics of sustainable principles, and a comprehensive reevaluation of the connection between humans and land. The three primary portable studies have consistently concentrated on the vehicle, the component, and the most appropriate scale for transportation. The fundamental idea of transport capacity pertains to the ability of cars to transport goods. The vehicular entity often denotes the complete ecological framework on Earth, whereas transportation subjects encompass diverse actions in that setting.

It is essential to objectively assess the capacity for carrying assets and the surroundings from several perspectives, including that of the bearer or carrier's object, which encompasses the material foundation and advanced economic activity. Freight capability is considered an asset and a biological boundary in the context of natural fundamental requirements for human financial growth. The red line represents the threshold, which denotes the size limit. From the standpoint of economic development, the capacity to allocate resources and preserve the environment reflects the extent of human behavior facilitated by the economy, contingent upon the absence of environmental harm and the promotion of equitable growth. A distinct social rate of expansion and developmental strategy can influence the alteration in the availability of resources and environmental conditions.

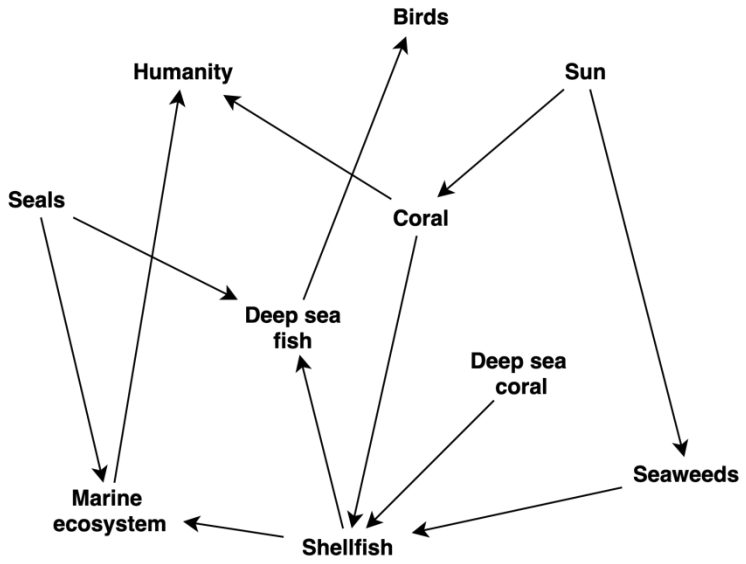

Figure 2: Marine Ecosystem

Figure 2 illustrates the marine ecology. As human comprehension of ecosystem services expands, the notion of underwater ecosystem service operations grounded on these services has arisen. Studying marine ecosystem services and capacities can enhance understanding of the ocean, facilitate its utilization and conservation, and contribute positively to guiding scientific inquiry and reasonable utilization of assets in future years. The marine environment's functional services differ from the sea's conventional services to humanity. The extent of the marine environment is less than the region encompassed by the marine services paradigm.

4 Implementation

1) Basic Ideas of Digital Implantation

The basic idea of digital implantation is to transform the contained cultural content, cultural information, and characteristic cultural elements into digital forms using digital animation, digital three-dimensional scenes, digital three-dimensional models, digital images, graphics, and texts to form digital cultural contents-implanted objects. Through the integration of AR technology, it adheres, integrates, and penetrates various carriers implanted in digitalization and realizes cultural implantation in the cultural sense of the productization carrier. In this paper, the forms of material medium carriers formed in transforming and developing protection for production are summarized and divided into three types: folk handicraft art, museum, and landscape. Among them, the folk handicraft type belongs to the material carrier form, and the museum and landscape types belong to the space carrier form, as shown in Figure 3.

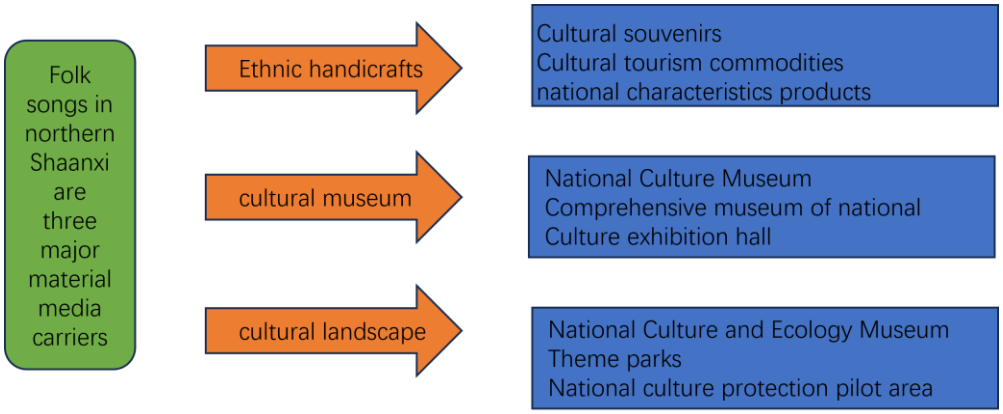

Figure 3: Type Pattern of Central Plant

Figure 4 shows the basic idea of implementing digital implantation in the carrier form of ethnic handicrafts. The digital implantation of ethnic heritage culture is carried out as the material carrier of ethnic handicraft products, and its primary point of emergence and landing is to break through the physical space limit of physical products. The rich cultural contents related to cultural products are implanted into physical products in digital form to strengthen the cultural contents of ethnic handicraft products and the cultural carrying capacity of this type of cultural product. Enhance the cultural value of products so that ethnic handicraft types of cultural products go into the circulation of the cultural consumption market space, highlighting the cultural characteristics of ethnic areas and cultural product brands.

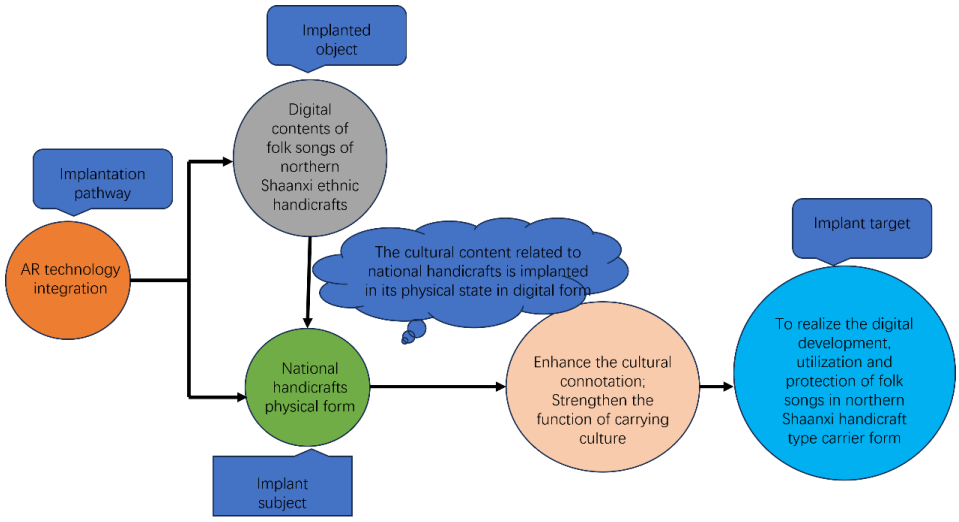

Figure 4: Cultural Digital Implantation of National Handicrafts by Type and Shape

Figure 5 shows the basic idea of implementing the digital implantation in the carrier form of a museum type. In traditional intangible cultural heritage museums, the basic concept of adopting cultural digital implantation comes from the limited display space of heritage museums. On the other hand, the

traditional display formula can not fully and intuitively explain and show the cultural background scene, characteristic culture, and story behind each exhibition. Through this method, intangible cultural heritage museums' primary and essential function and responsibility for displaying, educating, and disseminating heritage can be effectively strengthened.

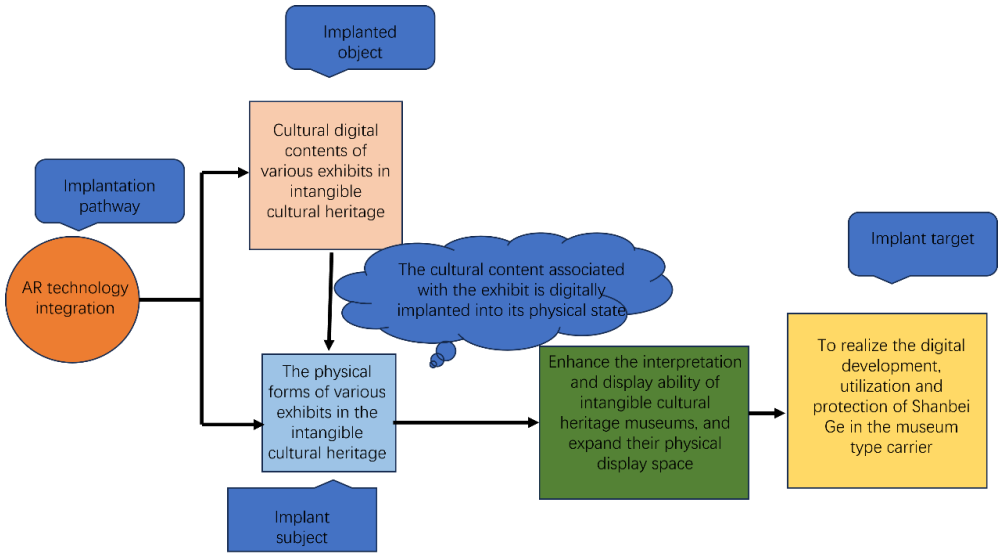

Figure 5: Museum-like Carrier-type Cultural Digital Implantation

Figure 6 shows the basic idea of implementing the digital implantation as a landscape-type material carrier. The integration technology is used to implement the digital implantation of culture in the form of landscape-type material carriers, and its basic idea is to strengthen the reconstruction and reproduction of the cultural and virtual fusion of ethnic characteristics in the landscape.

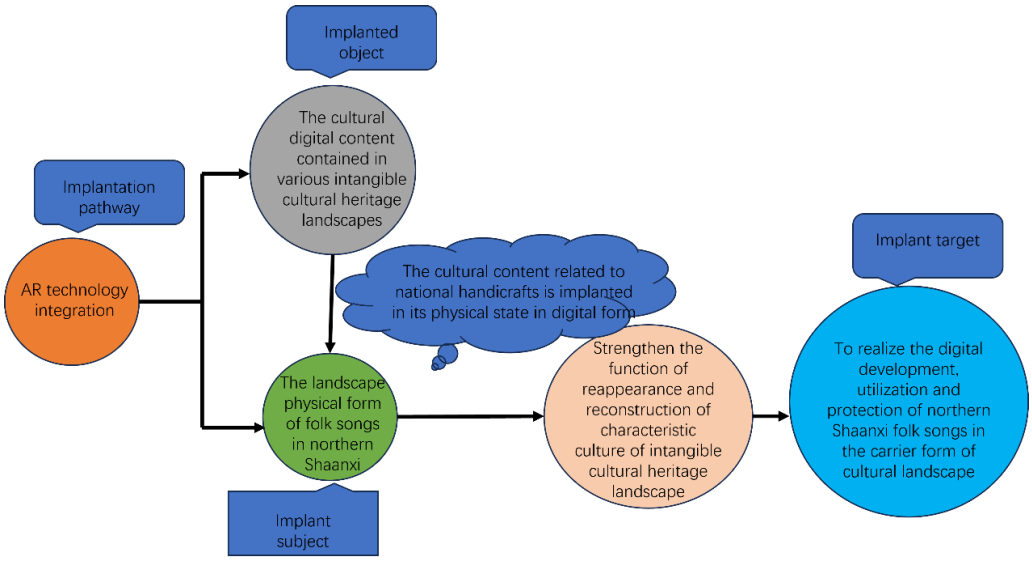

Figure 6: Digital Implantation of Culture in the Form of Landscape-type Carrier

2) Analysis of the Theoretical basis of Intelligent Construction Development Mode

RMP theory is a theoretical framework analysis model for transforming regional tourism resources into tourism products, first proposed by Professor Wu Bihu of Peking University in his National Natural Science Foundation project. The transformation of tourism products of regional resources here includes two aspects: the transformation of products from natural material resources and cultural tourism products from cultural resources. In the 1980s, regional tourism resources and products were almost equivalent. There was no need to develop resources too much, and tourism resources themselves were tourism products. That is to say, the resource presents a "resource source and product symbiosis," and the development mode of regional tourism resources presents a "low input and high output." By the late 1990s, due to the supply of tourism products becoming extremely rich, people could choose a lot of tourism products, and product competition was fierce; it was challenging to develop the situation that tourism products could become tourism products without too much investment in the resources created, that is, the resources present a feature of "upgrading of resources and products." Thus, the development mode of regional tourism resources presents the characteristics of "high investment, high yield, and high risk," which means that it must effectively develop resources and realize the transformation of regional resources. Figure 7 is a frame analysis model of Angstrom's theory on exploiting tourism resources.

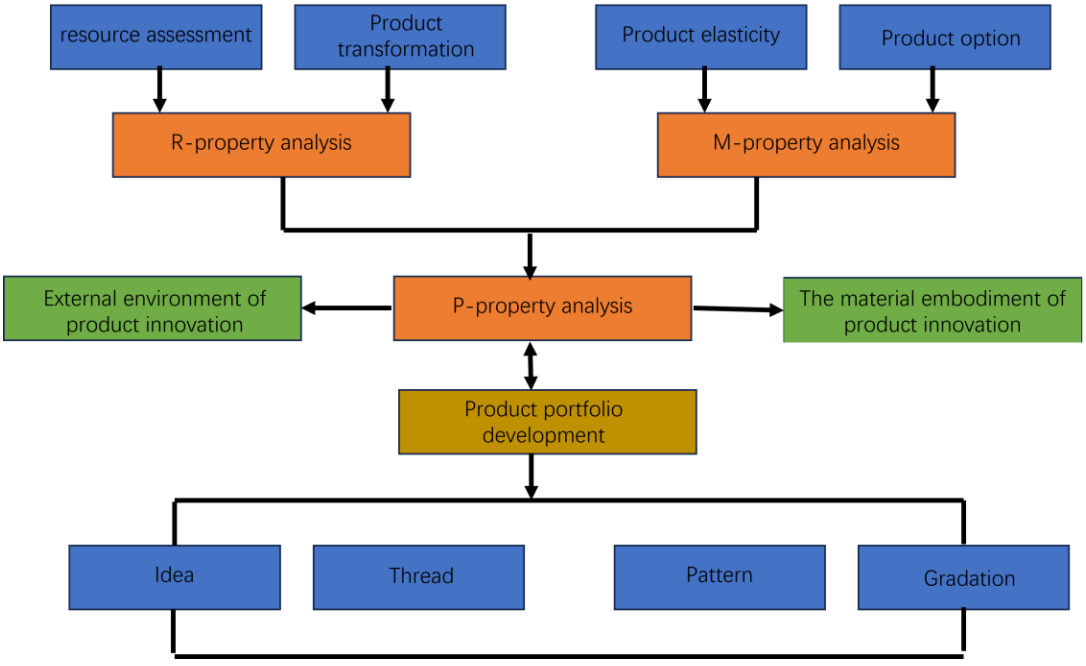

Figure 7: Analysis Model of Angstrom Spectrum Theoretical Framework

RMP was produced in response to these new problems faced by tourism development at that time. The theory emphasized that in the case of increasingly fierce competition in tourism products, more efforts should be made to develop cultural heritage resources into products to highlight the characteristics of regional cultural resources. Angspectrum theory believes that in developing tourism

products, the research should follow the framework model of analysis and demonstration of resources, markets, and products. Resource (R) analysis mainly focuses on the whole evaluation and analysis of regional tourism resources and studies how strategies transform resources into tourism products. Market (M) analysis mostly studies and analyzes tourists' elastic demand for tourism products and their preference for tourism products from the Angle of demand for tourism products and products as the point of origin. Product (P-nature) analysis is mainly based on resource (R-nature) analysis and market (M-nature) analysis to carry out specific innovative tourism product transformation design and development of resources.

As an essential cultural resource in the ethnic area, how can the research develop, utilize, and seek suitable carriers for them? Transform these "invisible, untouchable, and unexperienced" national traditional cultural resources into cultural products with national characteristics and further promote adequate inheritance in developing protection. Researching and designing a set of effective carrier-based and production-oriented innovative development modes is necessary. Angspectrum theory mainly takes regional tourism resources as the research object. It puts forward the analysis framework of the overall development model of promoting and transforming regional resources into tourism products. In the framework of theoretical analysis, the innovation strategy of cultural tourism products is mainly to transform cultural resources into cultural tourism products through the adjustment of urban planning and design, the construction and planning of museums and garden landscapes, etc. In essence, it is the primary thought and idea that the characteristic culture of the region is physically implanted in the physical cultural tourism landscape to realize the transformation of resources into cultural tourism products. To achieve the cultural tourism product characteristics of resource product promotion. In analyzing regional cultural resources, market demand, and product innovation, the Angspectrum theory does not involve using digital technology, information technology, and other modern scientific and technological means to intervene in the product transformation strategy of cultural resources. However, this theory still has important references and inspiration for the development model of digital implantation of construction culture proposed in this paper, which is a systematic thinking framework model for analyzing and demonstrating resources, market demand, and product innovation.

3) Construction of the Theoretical Framework of the Digital Implantation Model (CDIM)

The previous article explored the basic idea of embedding cultural inner content into the shape of three types of physical media carriers of ethnic handicrafts, museums, and landscapes in a digital form. Based on the Angspectrum theoretical framework analysis, This section combines the basic principles of AR technology to build a theoretical framework of digital implantation mode (CDIM) based on AR technology, as shown in Figure 8.

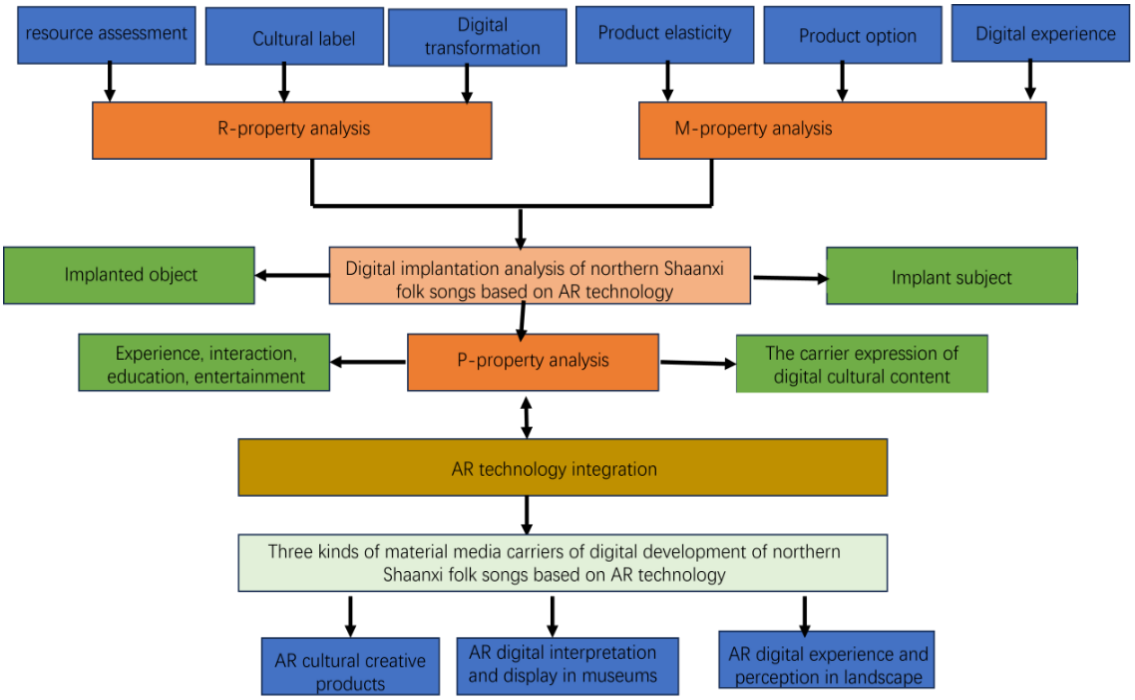

Figure 8: Theoretical Framework of CDIM, a Development Model for Digital Implantation

5 Results and Discussion

This section evaluates the suggested method using multiple metrics in MATLAB 2017. Three measures are utilized: safety duration, energy usage, and latency.

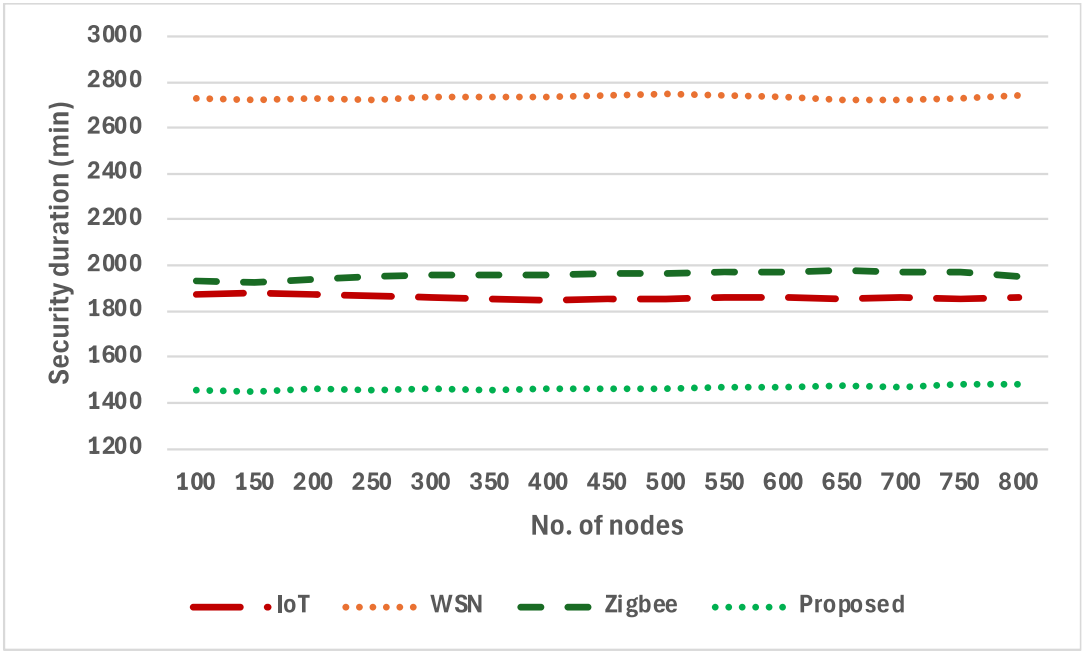

Figure 9: Safety Duration Analysis

Figure 9 illustrates the relationship between safety time and the number of connections. The initial efficiency of the proposed system is subpar, followed by a significant improvement. This outcome is primarily attributable to communication distance. The connectivity range variable in this figure allows a node to accommodate additional neighbors, resulting in a little increase in the channel used to transfer the data source, consequently adversely affecting efficiency. As the number of nodes rises, a single node cannot reach numerous neighbors, necessitating more hops for data relaying. The length of the link that transmits data grows, resulting in an extended safety time. The adversary's motion intersects the source information's communication line, resulting in fluctuating outcomes.

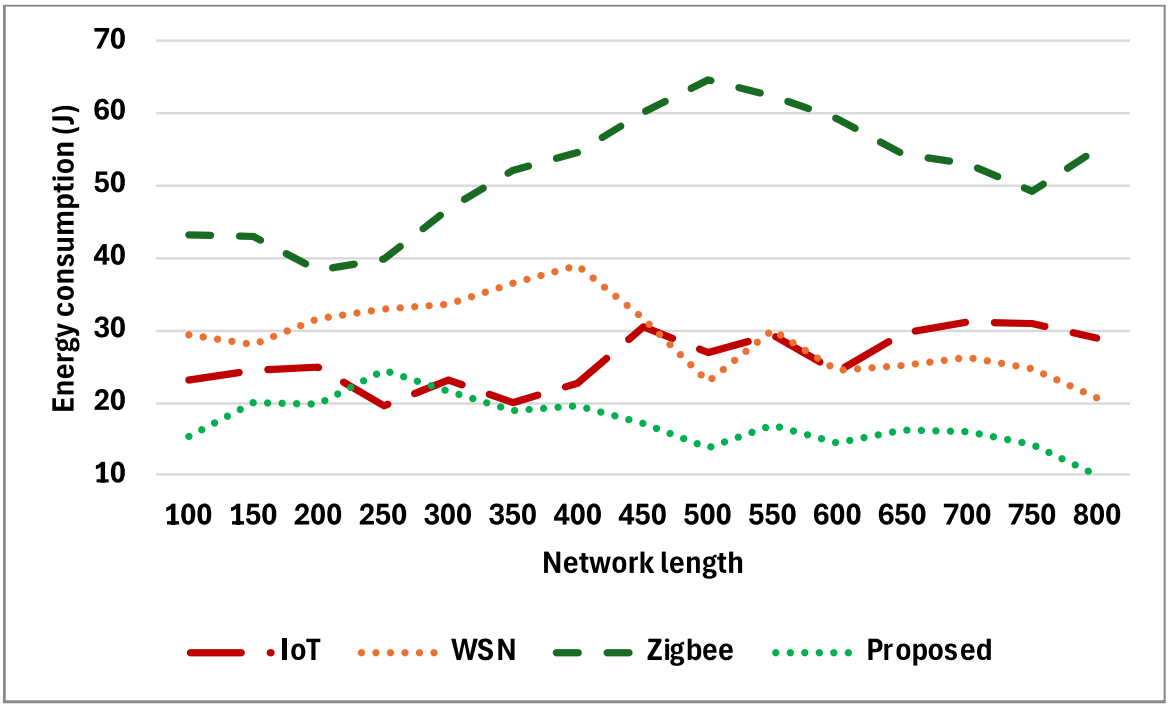

Figure 10: Energy Consumption Analysis

Figure 10 presents the comparative results for the energy expended by a node. The proposed model does not consume much more power than alternative technologies. The incorporation of attenuate weight and threshold imposes a slight load on the nodes during the implementation of the proposed model. A node experiences peak energy usage due to the traversal of many marines across all clusters, necessitating frequent data relaying. The energy usage is comparatively low, as several marine handle most operations within the network, resulting in their utilizing the bulk of energy.

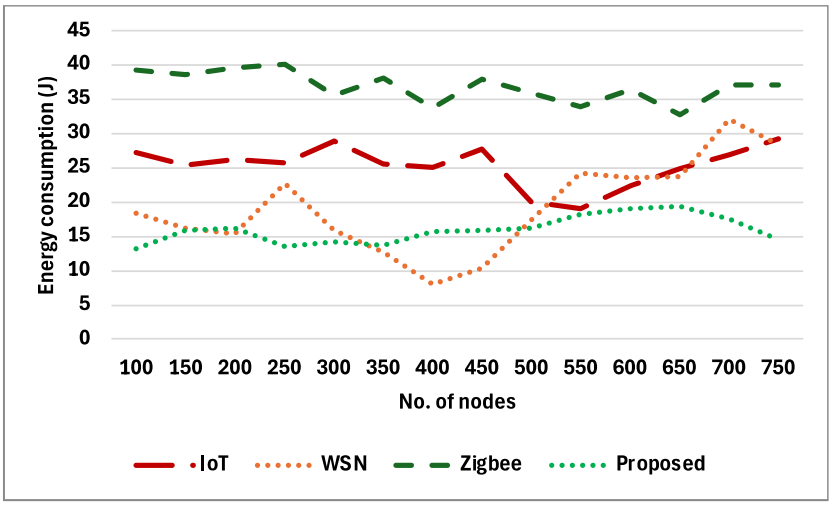

Figure 11: Energy Consumption Evaluation

Figure 11 illustrates the comparative results of energy usage based on the number of termina1s. Most operations are performed by nodes, including gaming and data conveying, resulting in substantial energy usage in every simulation run. The attenuated value accounts for the influence of the oceanic environment, incorporating data retransmission, which is not factored into the other four comparative methods. This contributes to the energy usage to a certain degree. The interaction range is a primary contributing element. An expanded communication distance encompasses more nodes; hence, only bordering nodes within this range participate in transmitting data, thereby minimizing power consumption. As the network grows, the influence of these two factors will increase proportionally.

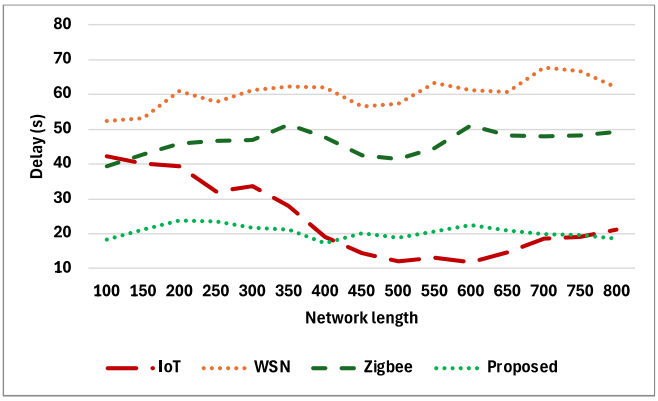

Figure 12: Latency Analysis

Figure 12 presents the comparative findings for the delay across the five strategies. A potential explanation for this is the employment of numerous nodes in the final three methods. Using attenuation load and threshold enables the nodes to transfer increased data to the sinks. Engaging in gameplay with an opponent will result in data circumventing the nodes adjacent to the competitor, affecting the latency somewhat. These variables influence the average latency, resulting in a rise in variability. The delay

seen in this work is primarily attributable to node dissemination, and the nodes only utilize portions of the delivery, resulting in suboptimal delay performance during the model. Position privacy protection necessitates extra technology to safeguard delivery, sometimes resulting in longer communication paths or more energy consumption. In this context, the latency is marginally compromised. In emergencies, the research believes that privacy safeguards are disregarded. Emergency data ought to be communicated as swiftly as feasible.

6 Conclusion

The maritime nation is progressively advancing towards being a dominant naval force. The marine conservation and payment system is a crucial institutional framework in my country's advancement towards becoming a maritime superpower. Establishing a marine environmental compensation mechanism is essential for developing a maritime nation. The marine ecological safeguarding and compensation scheme mitigates the harm to the marine ecosystems resulting from the creation and usage of marine assets while lessening the adverse effects of marine environmental damage on the long-term stability of the maritime economy. It aims to address the growth and usage of marine resources while mitigating the advancement of the maritime economy.

Safeguarding the marine natural ecosystem is the most productive approach. Expedite the development of a supportive framework for the underwater ecological preservation and reimbursement structure, ensuring its alignment with national conditions, thereby facilitating the healthy advancement of the marine environmental ecosystem throughout the nation. This article has some deficiencies. The chosen theoretical framework contradicts the realities of practical implementation. Due to the research constraints and the contributor's restricted analytical capacity, examining the issue needs more depth, and the proposed remedies must be sufficiently specific.

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