The Design and Execution of a Multimedia Information Intelligent Processing System Oriented to User Experience

Hongmei Liu

Chengdu College, University of Electronic Science and Technology of China, Chengdu 611745, China

***Abstract*—With the rapid growth of the world economy and the increasing pursuit of culture and entertainment, the integration of multimedia database technology and networks has become crucial. Through extensive research, this integration allows for seamless integration of multimedia information (MI) and promotes accelerated development of cultural exchange on the internet. This article studies and designs a multimedia information (MI) intelligent processing system for user experience (UE). This system integrates multimedia database technology and network technology, aiming to provide seamless integration of multimedia information, accelerate cultural exchange on the network, and enrich the cultural experience of users. In the system design, we propose a UE mode based on context-aware technology and develop an innovative access selection algorithm that can dynamically select the best access path based on network status and user preferences. The experimental results show that the algorithm performs well in terms of throughput, latency, and link load, effectively meeting the QoE (Quality of Experience) requirements of users. In addition, the system has high scalability and can cope with constantly growing data and computing needs without sacrificing performance. The implementation of this system not only provides users with a richer and more personalized cultural experience, but also provides strong support for building a more interconnected global community.**

Keywords*—User experience; multimedia information; intelligent processing; wireless network

Nomenclature			
MI	Multimedia information	I_{filter}	The result of the weighted average of the last three times
UE	User experience	Max	The maximum value of the corresponding model
QoE	Quality of Experience	k_1, k_2, k_3	The model coefficient
OS	Operating System	p	Path
DDN/FR	Distributed Data Network/File Replication	$jitter$	Jitter
LAN	Local Area Network	$delay$	The time delay
MAN	Metropolitan Area Network	$packet\_loss\_rate$	The packet loss rate
RTP	Real-Time Transport Protocol	CN	The crossing number
SLB	Server Load Balancing	n_k	the eight adjacent points of the current point P
QoS	Quality of Service	n	The number of pixels between the start point and the endpoint
QoE	Quality of experience	d_i	the direction code of each point
IP	Internet Protocol	D_k	Different image
ID	Identification	f_k	The frame image
QoE	Quality of Experience	R_k	Binary image
DSP	Digital Signal Processing	$Q_l(t)$	The backlog of the queue at the current moment of the link
ARM	Advanced RISC Machine	$\{A_l(t)\}_{t=0}^{\infty}$	The packet data quantity of the link time slot t arriving at the link
CPU	Central Processing Unit	c	The number of fuzzy-level values
		x	The number of input parameters
subscript		T	Candidates Network
S	Support		
C	Confidence		
I	The number of packets between the last two packets loses		
σ	Certain threshold		
I_{mprev}	The weighted average packet loss number before the last two packet losses		
I_m	The weighted average packet loss number		

I. Introduction

As society continues to advance in information technology, networking, and intelligence, the demand for multimedia information (MI) is on the rise, with a specific focus on audio and video content. In the past, a significant amount of time and effort was dedicated to resolving issues related to hardware devices and data formats during video processing. Unfortunately, the work done in this area was not easily transferable or reusable when transitioning to a new hardware platform [1]. In the experience economy, the central feature is the prioritization of humanization, where the user experience takes precedence over the mere functionality of products or services. This shift in focus recognizes the importance of creating memorable and meaningful experiences for customers, rather than solely providing a functional solution to their needs. People's demands for emotion and the realization of self-worth are becoming the focus of attention. Therefore, a more natural and easily accepted management application system based on context awareness has been widely considered and valued by researchers. A priori algorithm typically makes decisions based on historical data or previous experience. In the fields of multimedia information processing and user experience optimization, historical data (such as user preferences, network status, content consumption patterns, etc.) can provide valuable references for predicting future behavior or optimizing system performance. For multimedia applications, real-time response and fast decision-making are crucial. A prior algorithm is usually able to make decisions based on known information in a short period of time, thus meeting real-time requirements. Compared to complex machine learning or deep learning algorithms, prior algorithms often have lower computational complexity and higher efficiency. This is particularly important for processing large amounts of multimedia information and responding in real-time to changes in network status.

The idea of facing UE (user experience) has a long history. At present, there are many professional books about interaction design and UE that deeply explore the relevant interface design methods and criteria. Zhao [2] elaborated on the related knowledge of user interface design, usability design, and testing. Lv et al. [3] put forward that, according to the visual and psychological cognitive characteristics of users of handheld mobile devices, the principles and design methods that should be followed in the design of handheld mobile devices and their graphical interfaces are discussed and summarized. Pei et al. [4], based on the research on the relationship between the target UE and interface design, combined with the related theories of semiotics and product semantics, discussed the method of interface fashion design. Wang et al. [5] proposed that according to the visual and psychological cognitive characteristics of users of handheld mobile devices, the principles and design methods that should be followed in the design of handheld mobile devices and their graphical interfaces were discussed and summarized; Fei et al. [6] provide consulting services for enterprise UE optimization through data analysis. Jin et al. [7]pointed out that the experience of the real world affects users' expectations of the virtual environment displayed by the information system, and there are also differences among users with different cultural and ethnic backgrounds in their expectations of the interface and the ways of understanding the information provided by the interface. Jinkui et al. [8] think that emotional factors include direct and indirect emotional reactions on the one hand and more complex emotional results produced by the cognitive evaluation process on the other hand.

A comprehensive analysis was conducted by Liu et al. [9] on the implementation of an intelligent learning environment that emphasizes experiential learning. This paper focused on the analysis of the main problems, such as teaching-centered classroom settings unsuitable for classroom interaction, public learning spaces with low user experience, and a lack of teaching decisions supported by big data analysis.

Miraz et al. [10] demonstrated through their research that the adoption of dynamic techniques in user experience design can yield significant enhancements in user engagement and enjoyment, surpassing the outcomes achieved with more simplistic approaches. Li et al. [11] undertook a meticulous review of both literature and patents in four closely linked disciplines. Their primary aim was to present a comprehensive overview of the interconnections among these fields and evaluate their potential integration with smart energy management strategies. A study was undertaken to propose a conceptual framework for the development of a real-time self-adaptive user interface using the Android Operating System (OS). The primary focus of this study was to develop the core algorithms for the modules within the proposed framework. Moreover, this study emphasized the value of a customizable interface within the confines of an Android operating system [12].

Capece et al. [13] explored the development of "user experience" in terms of personal enjoyment and interaction with cultural locations by utilizing theoretical frameworks, concepts, and tools in their study. Consequently, this study investigates the restrictions imposed by data management and user privacy on the utilization of these systems. Additionally, it anticipates emerging prospects for augmenting and tailoring the user experience.

MI intelligent processing system is a distributed integrated system that organically combines video, audio, graphics, images, text, animation, and other media information processing. At present, research in this field at home and abroad often isolates the four basic aspects of MI processing technology, which makes it difficult to use various algorithms and tools to form a complex MI intelligent processing system [14]. At the same time, under the influence of service design and sharing economy thinking in the era of the experience economy, the development trend of Internet services has gradually changed from hardware and software construction to centralized cloud services. Looking at the current portable handheld devices, either the MI processing ability is not strong, the resolution is low, and the playback is not smooth enough, or only the video files in a single format can be played and processed, so the applicability is not strong. The system designed in this paper makes full use of Web technology and multimedia technology to obtain the information users need. This system can make users experience faster operation in a more beautiful operation interface and better bring convenience to the network culture and entertainment lives of the majority of netizens. Through this platform, the goal can be achieved and can effectively meet the various needs of users for multimedia applications.

II. Research Method

A. Demand Analysis

The concept of emotional design is becoming increasingly important in today's competitive market as companies strive to differentiate their products by creating meaningful and memorable experiences for users. Among the three levels of emotional design, the reflective layer corresponds to the strategic layer, the scope layer, and the structure layer in the UE element model, while the behavioral layer and the instinctive layer correspond to the design framework layer and the presentation layer, respectively. Therefore, the emotional design theory has important guiding significance for UE-oriented design methods.

MI intelligent processing system should try its best to meet users' needs, involve data processing at all levels and in all processing links, and focus on the management of meeting users and MI (pictures, videos, and audio). The software design should be modularized, which consists of five modules. The modules are closely related, and each module has its own characteristics. Corresponding configuration modules and usage tools are provided so that the system can be flexibly matched. With the continuous updating and upgrading of the network, the system's security has also been greatly challenged. The design of applied software and database systems should improve their security and prevent the invasion of illegal users. With the rapid development of technology, intelligent service systems have gradually penetrated into every aspect of our lives [15]. From smart homes to online shopping, from health monitoring to education and training, these systems have greatly improved our quality of life by providing convenient and efficient services. However, to make these systems truly effective, the key lies in the design of the human-computer interaction interface [16]. In intelligent service systems, user experience is the core of design. An excellent interface design should be able to visually display the system's functions, guide users to easily complete operations, and provide a pleasant feeling during use. To achieve this goal, we need to have a deep understanding of user needs and habits, as well as their usage scenarios in different scenarios. The interface design should support personalized customization, allowing users to adjust the interface layout, color, font, etc. according to their preferences and needs [17]. This can not only improve user satisfaction, but also enhance the emotional connection between users and the system. The system should provide timely feedback to users on their operations, allowing them to understand the current operational status and results. Reduce user anxiety and frustration through clear prompts and friendly error handling mechanisms [18].

Consistency stands as one of the most prevalent principles in design. Within the realm of design, consistency manifests not only through the uniformity and coherence of the style of every visual element present in the software interface, including icons, buttons, copywriting, and more. Moreover, it encompasses regularity in the application of intangible information architecture, interaction logic, interaction methods, and similar elements. When applications maintain a consistent level of performance, users are more likely to feel comfortable and at ease while using them. This consistency allows users to easily navigate through the content and find the information they need quickly. As a result, users are more likely to have a positive experience and continue using the product in the future.

Users have accumulated some knowledge and skills from their experience using the website, forming habits and expectations. Most of these conventions follow people's cognitive structure and mindset and become conventions because of their effectiveness, which should be paid attention to and fully utilized to reduce users' cognitive burden [19]. People's attention is concentrated and small in a short time, and the user interface based on recognition largely depends on the visibility of the objects that users care about. Displaying too many objects and attributes will make it difficult for users to find interesting objects. A software product with little memory burden is more popular with users. It can enhance user stickiness, improve work efficiency, and improve the success rate of tasks. Interaction designers should pay attention to these aspects when designing products.

B. The General Structure of the MI Intelligent Processing System

The exponential expansion of data in the online realm has rendered the conventional approach of constructing hardware and software infrastructure for data storage and retrieval inadequate to cater to the evolving needs of internet-based businesses [20]. Cloud services are provided to users by seamlessly integrating these flexible and scalable virtual fundamental service resources. By leveraging the services offered by cloud service providers over the Internet, users can achieve their desired functionalities, thereby revolutionizing the conventional approach of investing significant resources in constructing hardware and software infrastructure [21]. Through the implementation of a centralized software and hardware service model, cloud services effectively achieve the functional goals of computing power, speed, performance, and security. Additionally, this model introduces new requirements for creating a comprehensive and user-focused experiential service.

A good information system should have initiative and can actively perceive the information of users' behaviors, and the information push mechanism of commodities is the embodiment of the system's active perception [22]. Most of them push products to consumers according to the similarity of product information, which can only provide the most basic information and can't speculate on the user's commodity preference.

The principle of the Apriori algorithm, based on association rules, is to discover hidden relationships between data sets [23]. In this paper, the support degree is represented by S and the confidence degree is represented by C. The specific definitions of the two are as follows:

$$S = P(A \cup B) \quad (1)$$

$$C = \frac{P(A \cup B)}{P(A)} \quad (2)$$

In this paper, we will integrate, model, plan, and classify all kinds of situation information involved in the system and refer to the characteristics of time situation and user behavior situation in association rules to improve the user preference model and match it with similar product information in the system.

The congestion control algorithm used in this topic is based on the parameters related to the packet loss rate collected by the server [24]. If the packet loss rate L is greater than a certain threshold σ, the sender will appropriately discard some data frames in the video data. Let I represent the number of packets between the last two packet losses, and I_{mprev} represents the weighted average packet loss number before the last two packet losses. The weighted average packet loss number I_m can be expressed as:

$$I_m = (1-\alpha)I_{mprev} + \alpha I_{filter} \quad (3)$$

$$I_{filter} = \beta_1 I_{mprev-1} + \beta_2 I_{mprev-1} + \beta_3 I \quad (4)$$

Where I_{filter} is the result of the weighted average of the last three I times.

This system adopts a hierarchical and structured design. The multimedia processor with high performance and a built-in hardware codec acceleration engine should be configured. It can complete the real-time coding and decoding of multi-channel video, double-channel 1080P video, or single-channel 4K video. It has an Ethernet interface and a wireless Wi-Fi interface and supports wired and wireless dual-mode transmission of streaming media [25], [26]. At the same time, the system should have a basic intelligent video analysis function and provide basic intrusion detection and abnormal alarms to reduce the large amount of labor cost and workload brought by large-scale monitoring, improve the accuracy rate, and ensure no false alarm or false alarm. The overall architecture of the system is shown in Fig. 1:

It comprises a front-end video coding server, a camera, a tripod head, a tripod head decoder, and various alarm input devices. It can be LAN, MAN, the Internet, or any combination of these networks. We chose the Internet here. Includes a client, an enterprise client, a web client, and a network management client. The client includes central client software and a TV wall system, and the web client is embedded in the web page for ordinary users. The client is responsible for managing and configuring the system.

Data compression is a commonly used expression to improve the efficiency of information transmission and storage in a processing system. By compressing data, the efficiency of information transmission between subsystems and inside can be improved [27]. If the knowledge is well defined, it will make the system a right-hand assistant for researchers and users, and it will be able to advise users to choose appropriate tools, verify the consistency of knowledge, and make decisions. The session control is carried out between the sending and receiving communication terminals through the server. The multimedia stream is transmitted by a real-time transmission protocol, and the solution of audio-video synchronization is also involved in the transmission process.

The multimedia code stream transmission subsystem receives that coded data stream from the miprocess subsystem and carries out RTP packet and transmission through the RTP Server. Clients can access it in B/S and C/S modes according to their needs. The decoder decoding module of the client is responsible for decoding and displaying the decoded code stream, and users can browse real-time images. The application architecture of the multimedia transmission subsystem is shown in Fig. 2.

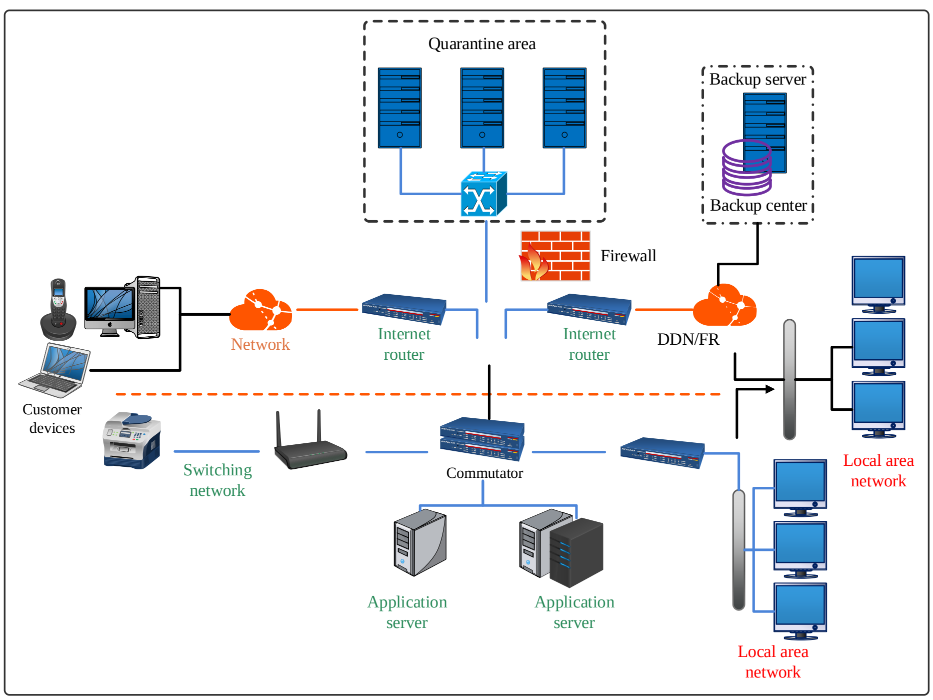

Fig. 1. Overall system framework diagram

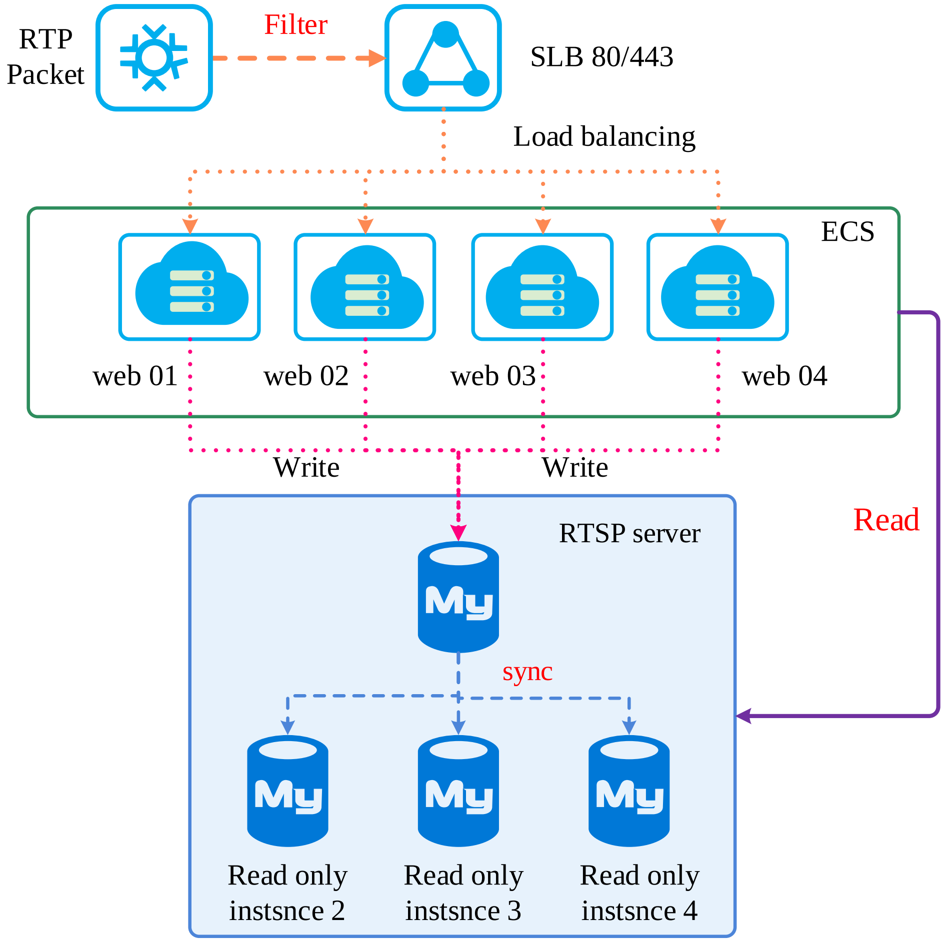

Fig. 2. Multimedia code stream transmission subsystem framework

The user management node realizes the functions of adding, changing, deleting, and querying user information. First, users register on the homepage, then log in, get their desired MI according to their personal preferences and characteristics, and play it to encode and decode MI at will.

According to the conditions set by the user before, the system will display all the found work items in the searched controllable area and show all the qualified documents in the query result list. All the information about the project is included in the content. So that the daily workload and status can be clear at a glance and the management efficiency can be greatly improved.

C. Key Technology Realization of the System

The interaction between users is realized by users' recommendations, evaluations, sharing, and forwarding of digital library information resources. In practice, digital library scientific research establishes its own user interaction platform or uses a third-party embedded user interaction platform to provide technical support for user interaction. The interactive experience evaluation between users and other users of the digital library can be carried out by sharing, recommending, commenting, and forwarding the information provided by the digital library platform. The user's interactive experience with the digital library system will affect the interaction between users and other users. Users will also interact and provide feedback on their experience of the digital library system with their organization, culture, and social background to correct their corresponding cognition.

A mobile terminal is often in the overlapping coverage area of multiple networks. Mobile terminals have different numbers and types of candidate networks in different service areas to access [21]. When a user wants to start a new service or switch, first determine the available network set around the user, and the networks in this set meet the basic QoS (quality of service) requirements of the service being used by the user. Then trigger the UE-based network access selection algorithm. The basic flow of the algorithm proposed in this paper is shown in Fig. 3.

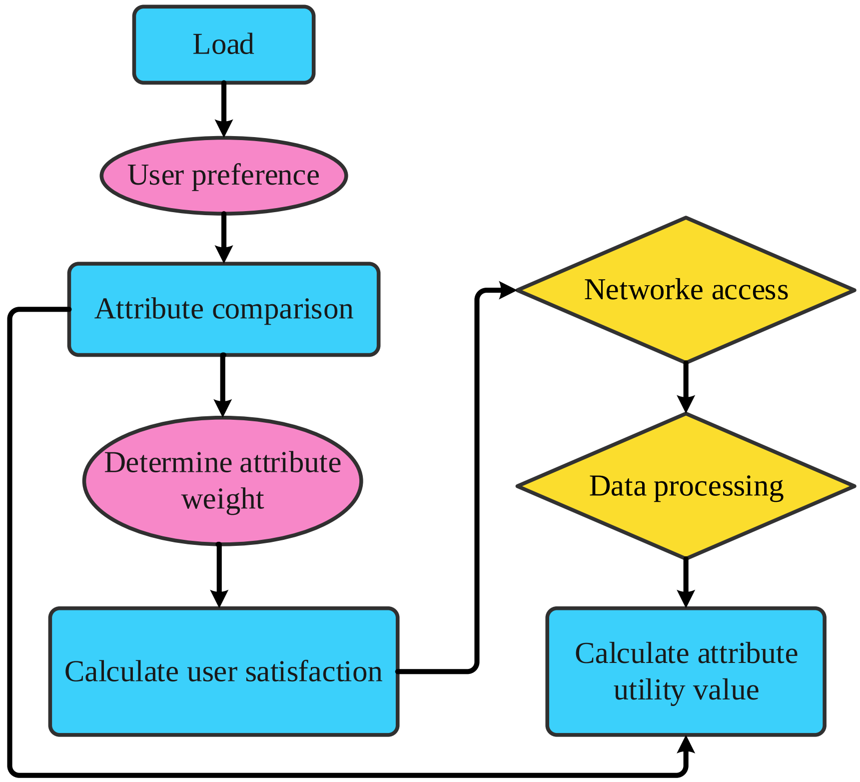

Fig. 3. Flow chart of network access selection algorithm based on UE

Satisfaction with a user's network or business is determined by the application used by the user and the user's preferences [22]. If users prefer to use the cheapest connection when browsing the web, the attributes to be considered will be biased towards the price. The mapping model between QoS and video QoE (quality of experience) is established through regression analysis, and the corresponding model coefficients are determined. On the premise of not losing generality, the following extended form is given:

$$QoE(p) = Max - k_1 * jitter(p) + k_2 * delay(p) + k_3 * packet\_loss\_rate(p) * 100 \quad (5)$$

where Max is the maximum value of the corresponding model; k_1, k_2, k_3 is the model coefficient; p is a given path;$jitter$ is jitter, $delay$ is the time delay, and all single bits are ms; $packet\_loss\_rate$ is the packet loss rate, which is a decimal in the range of 0 ~ 1.

The endpoint can be determined by the number of intersections. The crossing number CN of pixels of (i, j) is defined as:

$$CN = \frac{1}{2}\sum_{k=1}^{8}|n_k - n_{k+1}| \quad (6)$$

in which n_k is the eight adjacent points of the current point P, $n_k \in \{0,1\}$ and $n_9 = n_1$, then $CN = 1$, at that time the pixel(i, j) is an endpoint.

If the next point of P is n_1, the length of the curve track of $d_p = i$ is defined as:

$$L = \sum_{i=1}^{n} 1(d_i) \quad (7)$$

$$1(d_i) = \begin{cases} 1 & if\ d_i = 1,3,5,7 \\ \sqrt{2} & if\ d_i = 2,4,6,8 \end{cases} \quad (8)$$

where n is the number of pixels between the start point and the endpoint and d_i is the direction code of each point. If the ratio is less than a certain value, it is considered that there is no inflection point.

Through morphological filtering and connectivity analysis, the area with the connected area larger than the given threshold is judged as the target.

$$D_k(x, y) = |f_k(x, y) - f_{k-1}(x, y)| \quad (9)$$

$$R_k(x, y) = \begin{cases} 0 & D_k(x, y) \le T \\ 1 & D_k(x, y) > T \end{cases} \quad (10)$$

A difference image D_k is obtained by the gray levels of pixels at the positions corresponding to the k-th frame image f_k and the $k - 0$-th frame image f_{k-1}, and then threshold judgment is performed on the difference image to distinguish the foreground and background points, and a binary image R_k is obtained.

The location agent is the bridge between the monitoring center and the broadcast terminal. Because the IP addresses of the monitoring center and the broadcast terminal are both dynamic, a location agent is required for data transmission. The monitoring center can accurately transmit commands and files to the designated playing terminal. The workflow of the agent is shown in Fig. 4.

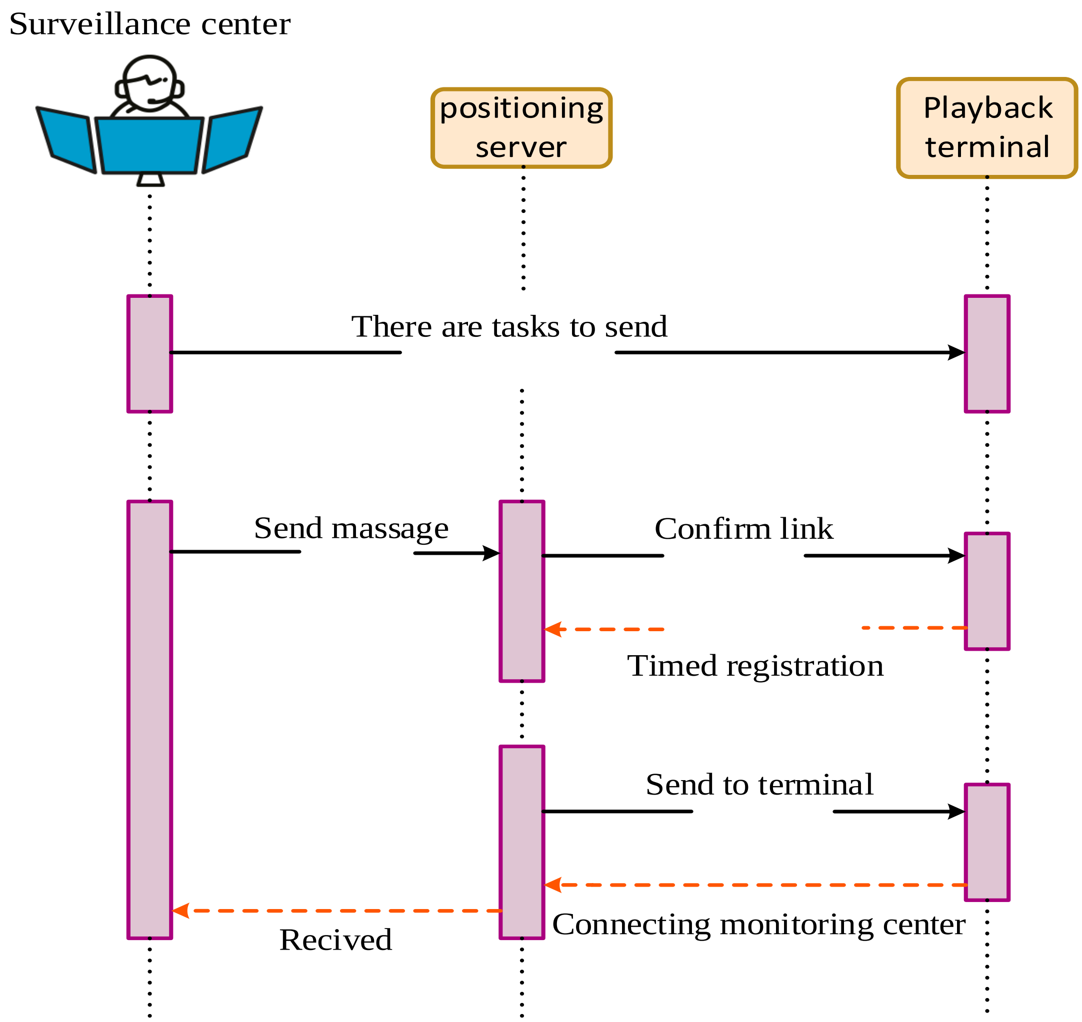

Fig. 4. Location agent workflow chart

When the monitoring center operates the broadcast center, the positioning agent receives the command from the monitoring center, finds the ID of the broadcast terminal to be operated by the monitoring center and the corresponding socket, and rewrites the current time and socket of this test into the data structure of the corresponding ID to ensure that the broadcast terminal is always online. The location agent is ordered to write the received ID into the data structure tasks and wait for the application of the playback terminal.

The development of wireless networks is not limited to the traditional mode of packet forwarding by base stations for access points but can be called IP-based wireless networks. Under the time slot model, data arrival is a discrete process, and the dynamic queue process of each link is described as follows:

$$Q_l(t+1) = \left(Q_l(t) - S_l(t)\right)^{+} + A_l(t) \tag{11}$$

$l = 1,2,\cdots,L$, $Q_l(t)$ is the backlog of the queue at the current moment of the link and $\{A_l(t)\}_{t=0}^{\infty}$ is the packet data quantity of the link time slot t arriving at the link l.

If there is a conflict in the broadcast process, the link will give up the transmission opportunity for this time slot:

$$S_l(t) = S_l(t-1) \tag{12}$$

In the fuzzy reasoning module, corresponding rules need to be set according to the number of input parameters and the number of fuzzy grade values. The number of rules l is:

$$l = c^{x} \tag{13}$$

Where c is the number of fuzzy level values and x is the number of input parameters. When the input parameters increase, the number of rules will increase exponentially, and at the same time, the number of rules will also affect the complexity of deblurring [23].

The two-stage fuzzy logic system obtains the accurate output value F, and the output value set of the candidate network set is $F = \{F_1, F_2, \cdots, F_M\}$, and the candidate network T with the largest output value is selected as the target network to perform switching, that is:

$$T = max\{F_1, F_2, \cdots, F_M\} \tag{14}$$

For any link, if the queue length is expected to be bounded, then the system queue is stable, namely:

$$\lim_{T\to\infty} \frac{1}{T} \sum_{i=1}^{T} E[Q_l(t)] < \infty \quad (15)$$

It is proven whether the system will be overloaded by calculating the expected value of the cache queue length. If it can be proved that the expected value of the queue length is less than infinity, then the system can remain stable.

According to the weighted average method, the total utility value of each attribute provided by users to this candidate network can be obtained; that is, the total satisfaction is:

$$S_i = \sum_j^n u_{ij} w_i \quad (16)$$

Rank the satisfaction of candidate networks, and the network corresponding to the maximum satisfaction is the optimal target network. Users try to access this network, and if the connection is unsuccessful, they try to access the suboptimal network.

III. Result Analysis

System testing plays a crucial role in the overall process of system development. Its primary objective is to evaluate whether the functional and performance benchmarks outlined in the system requirement definition phase have been successfully achieved. By conducting system testing, developers can ensure that the system operates as intended and meets the predetermined criteria. Black-box testing treats the tested system as a black box, inputting data from the outside, and then verifying the output results. White-box testing, on the other hand, involves understanding the structure of the tested object, consulting the content of the tested code to assist in the testing work, understanding the internal design structure of the program and the specific code implementation, and designing test cases based on this knowledge.

The randomly generated topology verifies the computational scalability of the algorithm, while some famous Internet topologies validate the practicality of the algorithm. The famous Internet topologies used in the experiment are ArpaNet, ItalianNet, and AnsNet.

According to the QoE model, the corresponding model coefficient k_1, k_2, k_3 is obtained, and it is tested in ArpaNet, ItalianNet and AnsNet, respectively, and the success rate and running time are recorded, as shown in Tables I to III.

TABLE I. SUCCESS RATE AND RUNNING TIME (ARPANET)

Model grade	Education		Science and technology	
	Success rate	*Running time /μs*	*Success rate*	*Running time /μs*
1	0.098	209.539	0.134	224.507
2	0.119	213.77	0.243	229.159
3	0.143	212.211	0.239	233.84
4	0.169	214.964	0.186	216.272
5	0.105	214.437	0.172	227.515
6	0.203	205.056	0.12	227.734
7	0.144	206.6	0.216	219.654

TABLE II. SUCCESS RATE AND RUNNING TIME (ITALIANNET)

Model grade	Education		Science and technology	
	Success rate	*Running time /μs*	*Success rate*	*Running time /μs*
1	0.181	322.504	0.106	348.499
2	0.143	342.662	0.176	346.928
3	0.229	337.694	0.216	358.174
4	0.151	337.412	0.29	361.18
5	0.213	317.992	0.274	357.943
6	0.262	336.828	0.11	374.232
7	0.289	330.977	0.29	341.311

TABLE III. SUCCESS RATE AND RUNNING TIME (ANSNET)

Model grade	Education		Science and technology	
	Success rate	*Running time /μs*	*Success rate*	*Running time /μs*
1	0.401	761.02	0.318	725.638
2	0.398	747.615	0.318	738.726
3	0.276	737.882	0.318	761.595
4	0.37	722.085	0.213	743.817
5	0.345	751.548	0.304	743.103
6	0.313	740.492	0.293	740.316
7	0.289	724.901	0.391	732.85

It was found that the ArpaNet with the fewest number of nodes and links has the shortest running time and the lowest success rate. ItalianNet, with the largest number of nodes and links, has the longest running time and the highest success rate. The success rate and running time of the optimal routing algorithm based on the QoE evaluation model are very close when the QoE level is 1 ~ 7, which shows that the running time of the algorithm will not increase with the change in QoE demand but only depends on the network topology.

Fig. 5 and 6 count the average satisfaction of all users in different user ratios. When the service arrival rate is high, the comparison algorithm shows slightly higher satisfaction, because users always choose their default optimal network access in the comparison algorithm.

Run H.264 encoding and decoding algorithms on DSP (Digital Signal Processing) respectively, and the load measurement results on DSP are shown in Fig. 7.

The running results can test the load of the H.264 decoding algorithm on the DSP core and the load of video playback on the ARM core. The video decoding frame rate ranges between 20 and 50 frames, with a decoding rate typically around 5 Mbps. The running test load of the codec on the DSP core shows that the CPU load consumed by video coding is higher than that of video decoding.

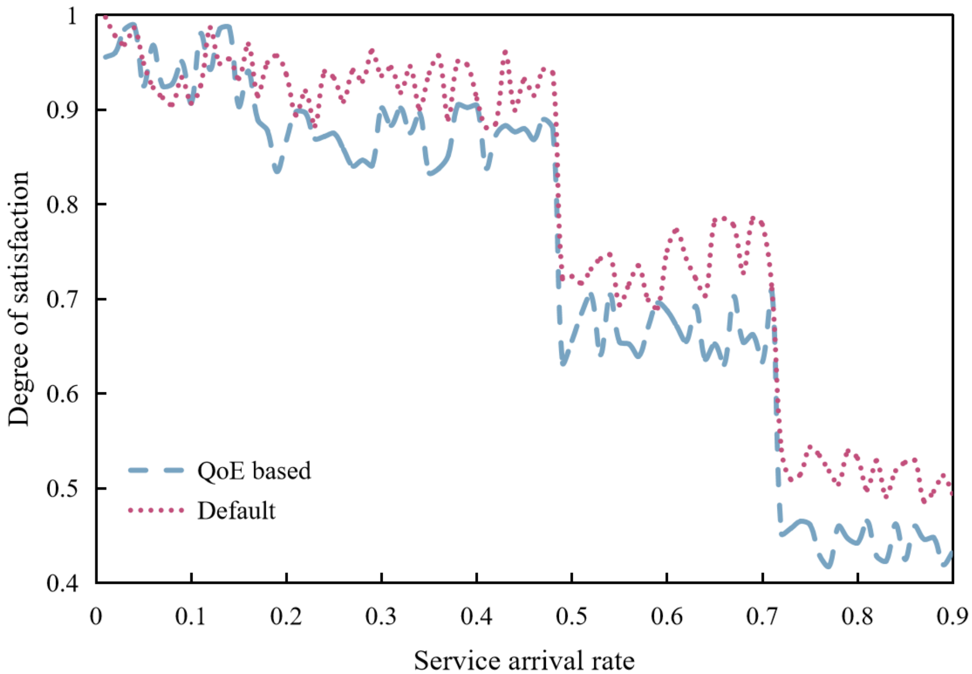

Fig. 5. Average user satisfaction under the user ratio of 1: 1

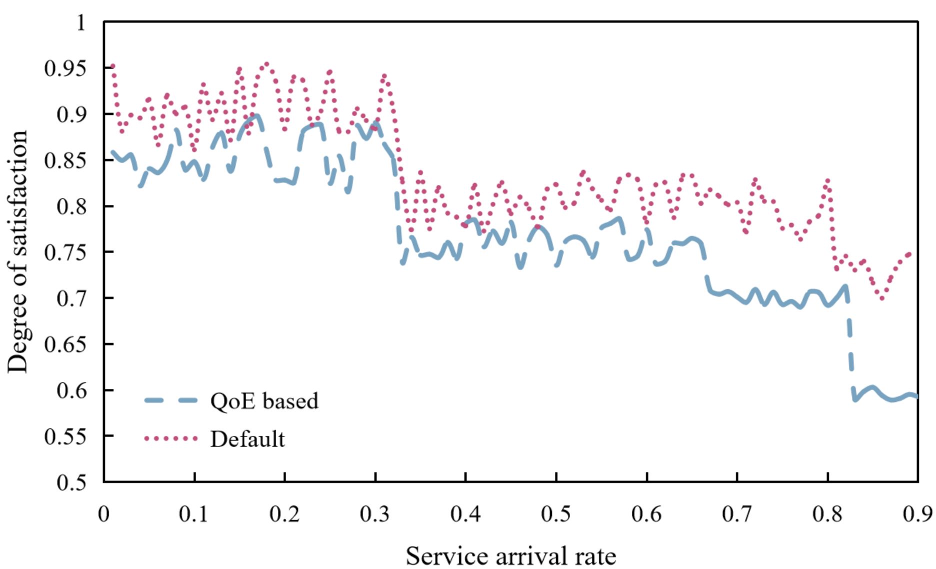

Fig. 6. Average user satisfaction under the user ratio of 2:1

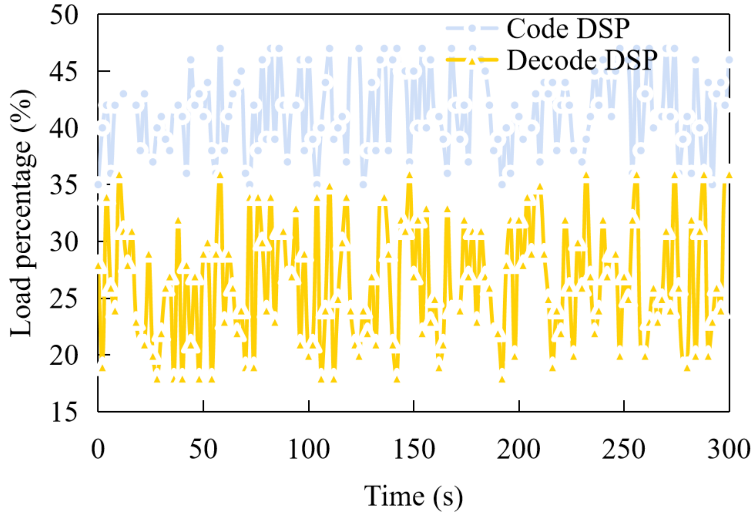

Fig. 7. Load of codec algorithm on DSP

During testing, if the number of test cases is limited, a range of values is also given. Then, choose a few test cases less than the minimum number and a few more than the maximum number to generate test data. When the tester has divided the test case interval, it is more appropriate to select several values near the boundary of the interval when choosing the values. The test results play an absolute guiding role for programmers in debugging programs. However, even if the program has passed the above tests, it doesn't mean that the software has no problems or loopholes.

Fig. 8 compares the handover blocking rate performance of the four algorithms with the trend of increasing the number of users. The blocking rate is defined as the ratio of blocking users to total users during handover.

As can be seen from the figure, when the number of users is 30, the algorithm starts to block. This is because the ref [24] algorithm does not consider the network load, which causes the network to block prematurely. When the number of users is 40, the other three algorithms start to block. With the increase in users, the blocking rates of the four algorithms are increasing. Although the algorithm in this paper considers the load rate of the network, its weight is small, so it has little influence on the network judgment.

Fig. 9 shows the relationship between the total network throughput of the four algorithms and the number of users. The total throughput is the sum of the network throughput occupied by users after handover.

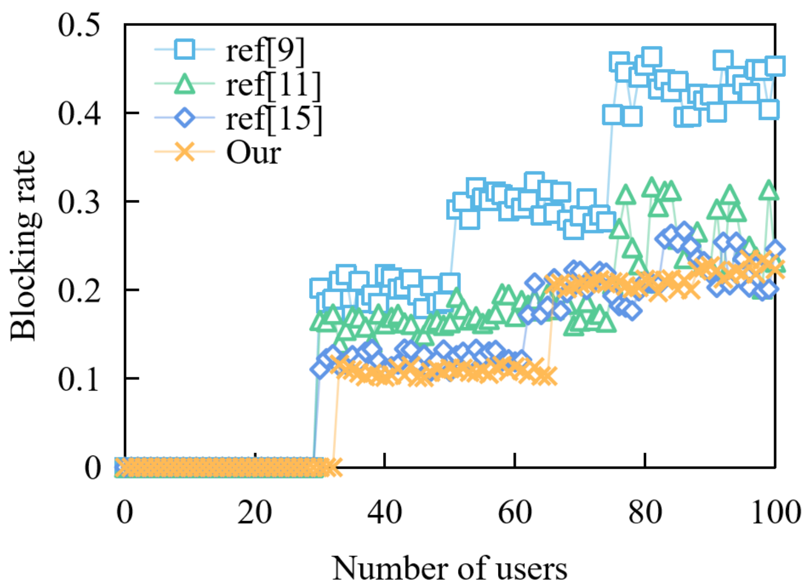

Fig. 8. Handover blocking rate

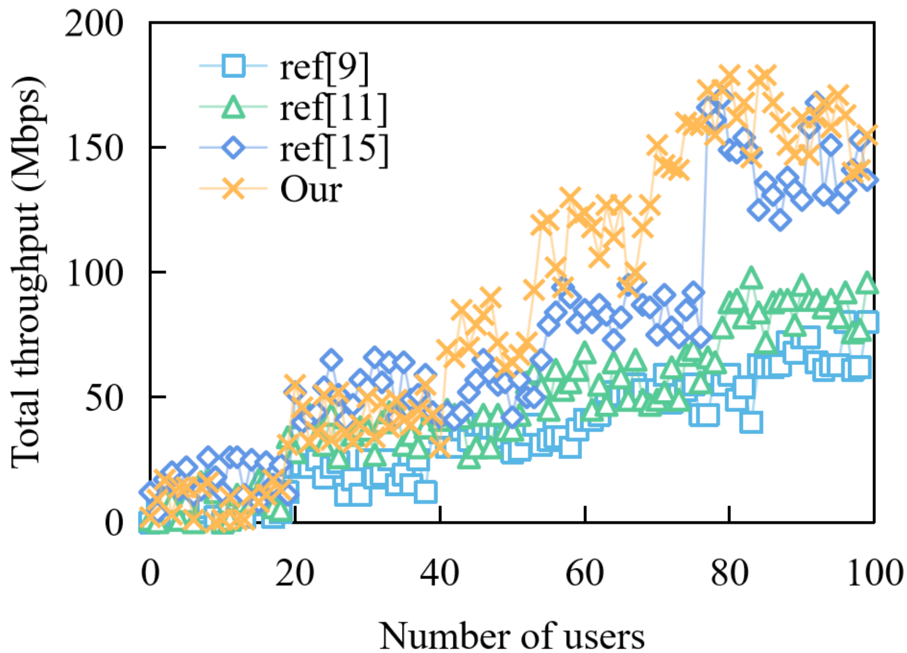

Fig. 9. Total network throughput

As can be seen from the figure, the total throughput increases with the increase in the number of users. When the number of users exceeds 20, the increasing trend of the total throughput of the algorithm gradually slows down. By balancing the load, congestion is reduced, allowing for continuous data transmission. The algorithm referenced in [24] has fewer parameters and does not test the network load, resulting in the highest blocking rate and the lowest network utilization rate, thereby yielding the lowest total throughput.

The most crucial aspect of the UE process is the feedback effect. Feedback is conveyed to users through the corresponding service information prompts on the product interface, aiding users in making choices and judgments. Therefore, a product or service must have a well-designed feedback system to better serve users. The principle of high efficiency forms the foundation for the system to meet UE requirements. To enhance the efficiency of information and data input in the system, many sensor devices can be utilized instead of manual input. This not only increases efficiency but also ensures the accuracy of information extraction to a great extent, significantly reducing labor expenditure.

IV. Conclusion

This paper delves into the intricacies of the MI management system and presents a novel approach in the form of an MI intelligent processing system. The design of this system is the result of a comprehensive investigation and analysis of the current state of MI management, focusing on addressing the practical requirements identified through real-world application scenarios. Analyzing the existing system requires a meticulous examination of its specific characteristics and requirements. This in-depth evaluation will provide valuable insights into the complexities of the system, enabling the development of a comprehensive framework. It is worth mentioning that the system has demonstrated exceptional performance and functionality during rigorous testing, further highlighting its efficiency. Through the running results, the load of the H.264 decoding algorithm on the DSP core and the load of video playback on the ARM core can be tested. The video decoding frame rate typically ranges from 20 to 50 frames, while the decoding rate generally hovers around 5 Mbps. The algorithm's throughput scales proportionally with the increasing user base, ensuring that it can continue to meet the demands of a larger and more diverse audience. When the user population surpasses 20, the gradual slowdown in the increasing trend of the algorithm's total throughput becomes apparent. This results in a reduction in congestion and a more balanced distribution of the load, enabling continuous transmission of data. This study aims to develop and implement an MI intelligent processing system with the objective of fostering mutual learning and knowledge exchange. The primary goal is to create a platform where individuals can share their experiences and gain insights from one another.

The future of multimedia information (MI) management systems holds promise for various advancements and enhancements to elevate their functionality and efficiency. One potential area for improvement is the integration of AI and machine-learning algorithms. Through the utilization of artificial intelligence and machine learning technologies, tasks such as content tagging, classification, and recommendation can be automated, leading to a more intelligent and user-friendly system

Authorship Contribution Statement

Hongmei Liu: Writing-Original draft preparation, Conceptualization, Supervision, Project administration.

Data Availability

On Request

DECLARATIONS

Not applicable

CONFLICTS OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this paper.

AUTHOR STATEMENT

The manuscript has been read and approved by all the authors, the requirements for authorship, as stated earlier in this document, have been met, and each author believes that the manuscript represents honest work.

FUNDING

Not applicable

ETHICAL APPROVAL

All authors have been personally and actively involved in substantial work leading to the paper, and will take public responsibility for its content.

REFERENCES

[1] D. Gil, A. Ferrández, H. Mora-Mora, and J. Peral, "Internet of things: A review of surveys based on context aware intelligent services," Sensors, vol. 16, no. 7, p. 1069, 2016.

[2] C. Chen, H. Liu, and Z. Wang, "Analysis and design of urban traffic congestion in urban intelligent transportation system based on big data and Internet of things," in Proceedings of the 2019 International Conference on Artificial Intelligence and Computer Science, 2019, pp. 659–665.

[3] X. Lv and M. Li, "Application and research of the intelligent management system based on internet of things technology in the era of big data," Mobile Information Systems, vol. 2021, pp. 1–6, 2021.

[4] B. Lü, C.-Q. Pei, J.-S. Tian, W.-L. Wen, J.-F. Wang, and J.-S. Tian, "Design and Implementation of the Intelligent Streak Camera Control System Based on Internet of Things," 2017.

[5] Y. Wang, J. He, H. Zhao, Y.-H. Han, and X.-J. Huang, "Intelligent community medical service based on internet of things," Journal of Interdisciplinary Mathematics, vol. 21, no. 5, pp. 1121–1126, 2018.

[6] C. Fei, B. Jiang, K. Xu, L. Wang, and B. Zhao, "An intelligent load control-based random access scheme for space-based Internet of Things," Sensors, vol. 21, no. 4, p. 1040, 2021.

[7] Y. Jin, H. Gao, T. Hu, and X. Li, "Special issue on AI-driven smart networking and communication for personal internet of things, Part I," International journal of wireless information networks, vol. 26. Springer, pp. 131–132, 2019.

[8] H. Jinkui, "Design and application of substation intelligent management based on internet of things technology," Boletin Tecnico/Technical Bulletin, vol. 55, no. 4, pp. 322–328, 2017.

[9] G. Liu, Z. Liu, F. Lu, Q. Ye, and Z. Liu, "Design and application of University Intelligent Learning Environment Centered on Improving User Experience," in Design, User Experience, and Usability. Application Domains: 8th International Conference, DUXU 2019, Held as Part of the 21st HCI International Conference, HCII 2019, Orlando, FL, USA, July 26–31, 2019, Proceedings, Part III 21, Springer, 2019, pp. 457–471.

[10] M. H. Miraz, M. Ali, and P. S. Excell, "Adaptive user interfaces and universal usability through plasticity of user interface design," Comput Sci Rev, vol. 40, p. 100363, 2021.

[11] J. Li, M. S. Herdem, J. Nathwani, and J. Z. Wen, "Methods and applications for Artificial Intelligence, Big Data, Internet of Things, and Blockchain in smart energy management," Energy and AI, vol. 11, p. 100208, 2023.

[12] M. Ali, S. U. R. Khan, A. Mashkoor, and A. Taskeen, "A conceptual framework for context-driven self-adaptive intelligent user interface based on Android," Cognition, Technology & Work, vol. 26, no. 1, pp. 83–106, 2024.

[13] S. Capece, C. Chivăran, G. Giugliano, E. Laudante, M. L. Nappi, and M. Buono, "Advanced systems and technologies for the enhancement of user experience in cultural spaces: an overview," Herit Sci, vol. 12, no. 1, p. 71, 2024.

[14] H. Chen and J. Huang, "Research and application of the interactive English online teaching system based on the internet of things," Sci Program, vol. 2021, pp. 1–10, 2021.

[15] Xiong, X., & Hou, Y. (2022). Design of Human-Computer Interaction Product Interface of Intelligent Service System based on User Experience. International Journal of Advanced Computer Science and Applications, 13(12).

[16] Su, F. (2022). Based on the Role of Intelligent Multimedia Man - Machine Exchange in Product Design. Wireless Communications and Mobile Computing, 2022(1), 5836965.

[17] Liu, C. (2022). Artificial intelligence interactive design system based on digital multimedia technology. Advances in Multimedia, 2022(1), 4679066.

[18] Zhang, B. (2023). New Media Interactive Design Visualization System Based on Artificial Intelligence Technology. International Journal of Information Technologies and Systems Approach (IJITSA), 16(3), 1-14.

[19] G. Jia, G. Han, J. Du, and S. Chan, "Pms: Intelligent pollution monitoring system based on the industrial internet of things for a healthier city," IEEE Netw, vol. 33, no. 5, pp. 34–40, 2019.

[20] X. Huang, "Quality of service optimization in wireless transmission of industrial Internet of Things for intelligent manufacturing," The International Journal of Advanced Manufacturing Technology, vol. 107, no. 3, pp. 1007–1016, 2020.

[21] X. Wang, "Application of 3D-HEVC fast coding by Internet of Things data in intelligent decision," J Supercomput, vol. 78, no. 5, pp. 7489–7508, 2022.

[22] L. Zhang, H. Yuan, S.-H. Chang, and A. Lam, "Research on the overall architecture of Internet of Things middleware for intelligent industrial parks," The International Journal of Advanced Manufacturing Technology, vol. 107, no. 3, pp. 1081–1089, 2020.

[23] Y. Zhao, C. Cao, Z. Liu, and E. Mu, "Intelligent control method of hoisting prefabricated components based on Internet-of-Things," Sensors, vol. 21, no. 3, p. 980, 2021.

[24] Z. Chu, P. Xiao, D. Mi, H. Chen, and W. Hao, "Intelligent reflecting surfaces enabled cognitive internet of things based on practical pathloss model," China Communications, vol. 17, no. 12, pp. 1–16, 2020.

[25] W. Li, J. Zhu, Y. Zhang, and S. Zhang, "Design and implementation of intelligent traffic and big data mining system based on internet of things," Journal of Intelligent & Fuzzy Systems, vol. 38, no. 2, pp. 1967–1975, 2020.

[26] M. I. M. Eid and H. I. Abbas, "User adaptation and ERP benefits: moderation analysis of user experience with ERP," Kybernetes, vol. 46, no. 3, pp. 530–549, 2017.

[27] M. T. Thielsch and C. Thielsch, "Depressive symptoms and web user experience," PeerJ, vol. 6, p. e4439, 2018.