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An expert system for automating image and video editing services using AI, cloud and blockchain technologies

Nguyen Duc Xuan[1], Nguyen Ngoc Khang[2], Pham Van Khanh[3*]
[1]School of Business Administration, VNU University of Economics and Business, Vietnam National University Hanoi, Vietnam; nguyenducxuan@vnu.edu.vn (N.D.X.).
[2]11 Math 1, Le Quy Don High School for the Gifted, Vung Tau, Vietnam; nguyenngockhangvt@gmail.com (N.N.K.).
[3]Institute of Information Technology, Vietnam Academy of Science and Technology, Hanoi, Vietnam; khanhvietdm@gmail.com (P.V.K.).

Abstract: In the digital age, high-quality visual content plays a critical role in marketing, real estate, and personal branding. However, traditional image and video editing workflows remain manual, fragmented, and time-consuming. This paper proposes an expert system that automates the entire service chain of photo, video, and virtual architectural editing by integrating advanced technologies such as AI, chatbots, cloud computing, and blockchain. The system intelligently analyzes customer requests, assigns tasks to AI modules or human editors, ensures quality control, and securely manages payments through smart contracts. Designed as a cloud-native, microservice-based architecture, the platform is scalable and resilient, offering services through both web and mobile interfaces. Simulation results show a significant reduction in turnaround time, enhanced consistency in output quality, and increased processing capacity. By automating both technical and operational processes, the proposed system aims to transform digital content services into a seamless, efficient, and trusted experience. It has strong potential to attract customers and investors, especially in industries demanding fast, cost-effective, and scalable media solutions.

Keywords: *Artificial intelligence, Blockchain payment integration, Chatbot-driven customer interaction, Cloud-native architecture, Expert system, Photo and video editing automation.*

1. Introduction

In the digital age, high-quality image and video content has become a key element in marketing, real estate, and personal branding. Homebuyers, customers, and online users are increasingly attracted to eye-catching images and professional videos. Statistics show that 95% of homebuyers start their real estate search online, so the quality of the images posted has a direct impact on their decision [1]. Similarly, video content is dominating Internet traffic – it is estimated that by 2025, video will account for 82% of consumer Internet traffic [2]. This highlights the need to process and edit large volumes of photos and videos quickly and efficiently to serve the market.

However, the current process of editing images, videos and virtual architecture often requires many manual steps, from contacting customers, receiving requests, assigning to editors, post-processing, quality control to product delivery and payment. The traditional process is not only time-consuming but also potentially prone to inconsistent quality errors due to its high dependence on human factors. With the development of artificial intelligence and automation technology, there is an opportunity to optimize this service chain through an expert system. The proposed expert system is capable of automatically performing the entire service delivery process chain, integrating modern technologies such as AI computer vision, intelligent chatbots, cloud-native architecture to ensure scalability and blockchain to enhance transparency and safety in payment.

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* Correspondence: khanhvietdm@gmail.com

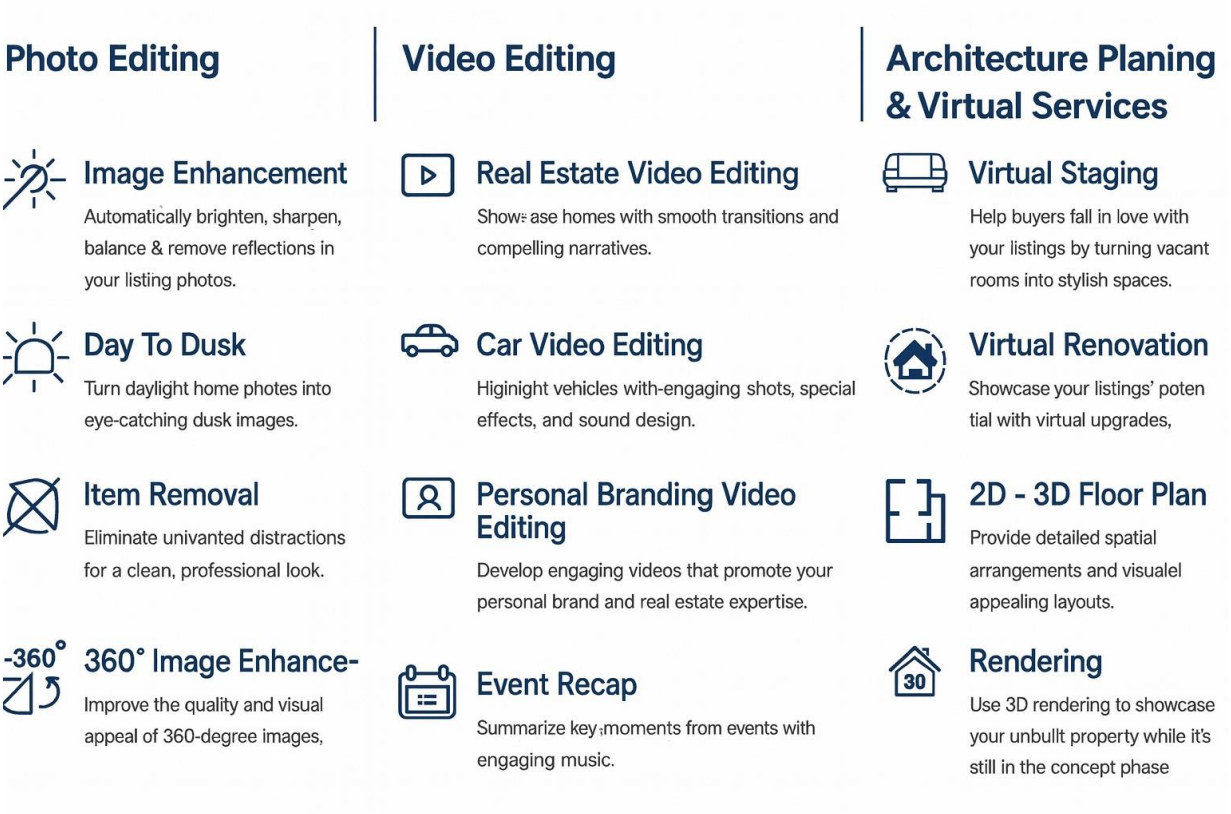

Figure 1.
Groups of photo, video, and virtual architecture editing services supported by the proposed system. (Left) Photo editing includes: photo enhancement (brightening, sharpening, color balancing), converting daytime photos to sunset (Day to Dusk), removing extra objects, and enhancing 360° photo quality. (Middle) Video editing includes: real estate video editing, car videos, personal branding videos, and event summary videos. (Right) Virtual architecture services include: virtual interior staging, virtual renovation, 2D-3D floor plan creation, and perspective rendering.

As illustrated in Figure 1, the system will support a variety of services based on user-provided images, including: (1) Photo editing – for example, *enhancing photo quality* , *turning daytime photos into evening photos* , *removing unwanted objects* , *improving 360° photos* ; (2) Video editing – for example, *creating real estate introduction videos* , *car advertising videos* , *personal branding videos* , *event summary videos* ; (3) Virtual architectural services – for example, *virtual interior staging* , *virtual space renovation* , *2D-3D floor plan design* , *3D perspective rendering* . The system will operate on both web app and mobile app platforms for user convenience.

The contribution of this study is to propose an expert system architecture that integrates advanced technologies to automate the entire service process mentioned above. Specifically, the paper systematically presents: the system's architecture and workflow; integrated core technology components (AI, chatbot, cloud, blockchain); and evaluates assumptions about the system's efficiency based on operational and business criteria. The proposed system aims to improve operational efficiency (reduce processing time, reduce personnel costs), ensure scalability when demand increases, and increase investor attractiveness through the application of "trend-leading" technologies.

The structure of the paper is organized as follows: The Literature Review section reviews relevant research and trends in the field of automatic photo/video editing, service expert systems, as well as the application of AI, chatbots, blockchain in similar systems. The Proposed Methodology section describes the system architecture and end-to-end workflow in detail. Then, the Technology Components section

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analyzes the role of each technology (AI, chatbot, cloud-native, blockchain) in the system. The test results present the scenarios and expected benefits when deploying the system, along with the Security & Privacy section discussing measures to ensure data and transaction security. Finally, the Conclusion & Development Directions summarizes the main contributions and suggests future research and development directions.

2. Document Overview

In areas such as real estate and digital marketing, the demand for professional photo and video editing services is growing rapidly. Virtual staging is a prime example in real estate: instead of spending time and money on real furniture, sellers can use technology to add virtual furniture to photos of empty rooms. The effectiveness of this method has been proven when staged homes (whether virtual or real) sell up to 73% faster than non-staged homes [1]. At the same time, 85% of staged homes sell for 5–23% more than the original list price [1]. These numbers show the significant commercial impact of using high-quality, presentational images in real estate. In addition, most buyers (95%) view properties online before deciding to make a purchase [1], so *improving the quality of real estate photos* (e.g. adjusting lighting, replacing the sky, removing unnecessary details) will increase the ability to attract buyers.

Similarly, in the marketing and social media space, video content is on the rise. Not only does video deliver more vivid information, it also has a high customer reach: Internet users spend an average of dozens of hours per week watching online videos, and businesses that leverage video marketing can significantly increase conversion rates. Cisco predicts that by 2025, up to 82% of all consumer Internet traffic will be video [2]. This requires the production and editing of large volumes of video in a short period of time. However, the process of professional video production is often complex, requiring high skills and a multi-step process (editing, color correction, adding effects, publishing, etc.). Many small businesses struggle because the cost of producing high-quality videos is still expensive in terms of equipment, software and human resources [2]. Therefore, the need for *automated or semi-automated solutions* to support video production and editing is becoming urgent.

AI applications in photo and video editing: Artificial intelligence has recently made great strides in analyzing and processing image content. Computer vision and deep learning algorithms allow many tasks that were previously done manually by humans to be automated. For example, AI can automatically improve the brightness, color balance, and sharpness of photos; research shows that smart photo editing tools can reduce processing time by up to 90% compared to traditional manual methods [3]. In real estate photography, many photographers have begun to integrate AI: a Pincel survey found that 58% of people working in this field have used AI to assist in photo editing [3]. Tasks such as automatic sky replacement from overcast to sunny blue skies, or HDR stitching from multiple exposures, can now be done in just a few seconds thanks to AI [3]. Particularly relevant to our service scope, AI has enabled the smooth removal of unwanted objects from photos: modern *inpainting tools* can recognize redundant objects (such as trash cans, wires) and erase them, naturally filling in the background [3]. This allows for clean, uncluttered photos without re-shooting the scene. Similarly, converting daytime photos into sunset scenes can also be achieved using deep learning *image-to-image translation models*. Recent research has used generative adversarial networks (GANs) such as CycleGAN or diffusion models to realistically transform day-to-night landscapes [4]. The results show that it is possible to generate nighttime images from daytime photos with high reliability, opening up the potential to automatically generate attractive *twilight images* for real estate without having to take photos at night.

In the field of video editing, AI has also begun to be applied to reduce the workload for editors. Automated video editing systems are a prominent trend, with the goal of *simplifying the post-production process and increasing efficiency* [5]. For example, video summarization algorithms can browse through hours of event footage and automatically select the most prominent segments to create a concise event recap video. Some experimental studies use reinforcement learning to teach machines to cut and re-slice videos according to cinematic principles, or use natural language processing (NLP) combined with

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vision to edit videos based on scripted dialogue (such as the system of Learning on Screen [5] to automatically create dialogue scenes) [5]. Although current AI applications for video are largely focused on simple cases (short videos, well-structured content), this trend promises to expand to more complex types of videos in the near future. For services such as *real estate videos* or *product advertising videos*, AI can assist in stabilizing frames, adjusting colors in batches, adding suitable background music, and even arranging video layouts according to available templates. These supports will help editors focus more on the creative aspect, while shortening the time to complete the product.

Expert systems and service process automation: The traditional concept of *expert systems* refers to computer systems that simulate human expert decisions based on encoded rules and knowledge. Today, with the support of AI, modern expert systems can flexibly combine rule-based reasoning and machine learning models to make optimal decisions. In the context of media editing services, an expert system can take on the role of an "intelligent coordinator" – automatically analyzing customer requests, then planning the implementation: whether to assign AI to process automatically or to which editor, what intermediate steps to go through, etc. There are related semi-automated platforms on the market. For example, Pixelz – an e-commerce product image processing company – has developed a "Photoshop pipeline" called SAW™, in which the photo editing process is broken down into hundreds of micro-steps performed jointly by AI and experts [6]. Reports that they have automated around 64% of their photo editing workload in 2021 (up from 20% a few years ago) [6] by applying *lean manufacturing* principles and training their AI on the data of millions of photos they have collected. Pixelz [6] CEO shares that by storing all Photoshop operations and analyzing this data, they can train the AI to solve each small step, guided by the accumulated knowledge of experts. Pixelz [6] experience shows that tightly combining humans and machines in a standardized process can significantly improve efficiency: order processing time is reduced from days to hours, even just minutes for a photo at scale. This illustrates the huge commercial potential if AI is properly exploited – in fact, Pixelz has received millions of dollars in funding thanks to its AI-centric development strategy.

However, there is still no platform that integrates all photo, video and virtual architecture services into a single, highly automated system. Processes such as customer communication, quality control, and payment are still largely handled by humans on freelancer platforms or via email, hindering user experience and making it difficult to scale. This is the gap that our proposed system aims to fill. By integrating chatbots for customer interaction and blockchain for payment management, the system will automate not only the technical editing process but also the entire service operation process. Advances in customer support chatbots show promise: studies show that chatbots can handle up to 70% of frequently asked questions from customers, freeing up human resources for more complex issues [7]. Notably, IBM estimates that businesses can save up to 30% on customer care costs if chatbots are deployed effectively [8]. Therefore, integrating AI chatbots into the system will help operate smoothly 24/7 without the need for a corresponding increase in support staff.

Finally, blockchain technology offers a unique solution to the problem of trust and transaction security in the digital service model. On traditional freelance platforms, there are often risks: customers who pay in advance are worried that the product will not meet their requirements, and service providers who deliver the product are afraid that the customer will not pay. Blockchain allows the deployment of smart contracts to act as a guarantee intermediary - the payment amount will be kept in the smart contract and will only be disbursed when the work is completed and satisfies the agreed conditions [9]. This model has been tested in a number of decentralized applications for freelancers, helping to reduce the risk of fraud and disputes thanks to the transparency and immutability of blockchain [9]. In addition, blockchain can also provide an immutable record of important transactions and data: once information (e.g., edit logs, transaction agreements) is recorded on the blockchain, it cannot be modified without being detected, ensuring data integrity [10]. These properties are very attractive to investors and high-end customers who value transparency and security. Therefore, integrating blockchain into the system promises to increase the trust of parties in the automated service platform we propose.

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3. Method

In this section, we present the overall system architecture and workflow from the beginning to the end of a service order. The proposed expert system is designed according to a multi-tier, microservices model deployed on cloud infrastructure, including the main components: customer interface (web/mobile app and chatbot), editor interface, intelligent business processor (request analysis, job assignment, quality control), specialized AI services for image/video processing, and a secure payment system integrated with blockchain. Figure 2 below describes the system architecture and the relationships between the components.

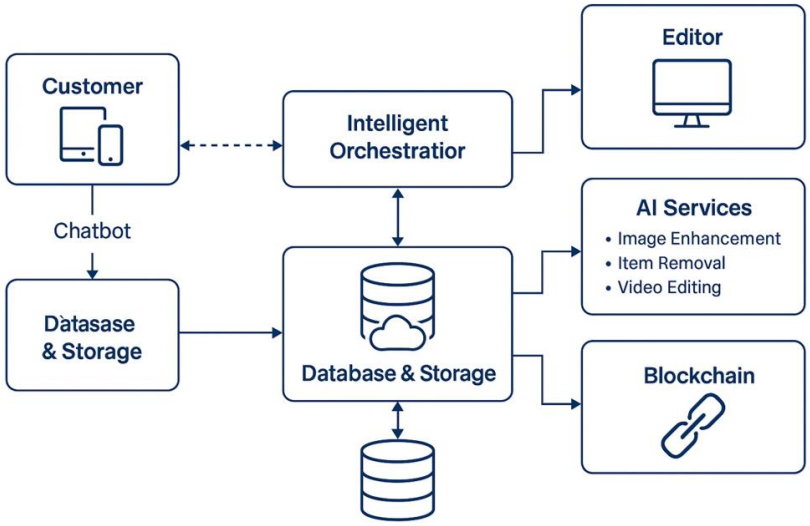

Figure 2.
Proposed system architecture (depicting the main components and data flow between them).

The system presented in Figure 2 includes: (1) Customer front-end on web/mobile app and chatbot, allowing customers to send requests and interact; (2) Editor front-end for editors to receive work and return results; (3) Intelligent coordinator (Middleware) plays the role of an expert system, handling the main business (analyzing requests using NLP, routing to appropriate AI services or editors, checking output quality); (4) AI services (microservices) that automatically handle tasks such as photo enhancement, object removal, video processing, etc.; (5) Database & cloud storage to securely store images, videos and order information; (6) Blockchain payment system ensures transparent and secure financial transactions.

(Note: Figure 2 is a hypothetical illustration, where the arrows represent the main interaction flow: customer sends request → chatbot/front-end receives → orchestrator analyzes and forwards → processed by AI or editor → result returned via orchestrator → customer receives product → payment via blockchain.)

3.1. System Architecture

The system is designed according to a layered service-oriented architecture. At the presentation layer, there are web and mobile applications for customers and editors. Customers can access the platform via a browser or app to create an account, submit edit requests, track progress, and receive the product. This interface has a built-in AI chatbot to support customers in entering detailed information (e.g., description of edit request, preferred style, desired deadline). The chatbot is capable of natural language processing, helping to guide customers to fill in the necessary information conveniently, and answering common questions (price, estimated processing time, etc.). On the editor side, they have a

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separate interface (also a web/app) to receive notifications when there is a new job, view request details, download relevant data (original photos/videos), and then upload the finished product. This interface also displays deadlines, allowing communication with managers or internal chatbots if requests need to be clarified.

At the business logic layer is the intelligent coordinator, considered the "brain" of the system (which is the *expert system part*). This component has modules such as: Request Analyzer, Task Scheduler, Quality Checker, and Workflow Manager.

- The requirements analysis module uses NLP to understand the customer's input description, classify the type of service (photo or video, which group), identify important keywords (e.g. "remove the car behind", "brighten the photo but keep the natural color", "build a modern interior" ...). Based on that, the system determines a set of tasks to be performed. Some tasks can be completely automated by AI (e.g. brightening, white balance), while complex tasks that require human hands (e.g. editing event videos that require many creative decisions) will be marked for assignment to the editor. This whole process is based on a set of expert rules combined with a machine learning model (trained on data from previously processed projects) to predict the optimal solution (automatic or manual, and who does it).
- The task planning and assignment module takes input from the requirements analysis and schedules the steps. If the task involves multiple steps (e.g., an image that requires AI object removal first, followed by an editor manually adjusting the lighting), the module will arrange the order of execution appropriately. Next, the module consults the human resources database to see which editors are available and have the appropriate skills (e.g., an automotive video editor, or an architectural perspective expert). This appropriate editor assignment can also be automatically suggested by the system based on the editor's skill score, performance history, and some rules (e.g., prioritizing those with less backlog, or rotating tasks to distribute work evenly). Similarly, if the task is decided to be handled by AI, the module will call the corresponding AI service (e.g., the object removal AI microservice) through internal APIs.
- The quality control module is responsible for evaluating the output before sending it to the customer. For edited photos or videos, the system can apply a number of automated quality assessment algorithms: for example, measuring resolution, sharpness, comparing before and after to make sure that the requirements have been met (objects to be removed are gone, lighting is improved but there is no noise, etc.). Computer vision AI can be trained to detect common errors (e.g. over-edited areas, incorrect skin tones, etc.). For criteria that are difficult to quantify (such as aesthetics), the system will combine with a manual review process: the product is sent to another editor or to the project manager for a quick check. Only when it passes this check will the product be considered complete. In case of errors or unsatisfactory requirements, the system will automatically send it back to the editor for further editing (possibly with specific comments if the AI identifies the problem).
- The process management module monitors the entire progress, ensuring that each order goes through the following states: *request received → processing (AI/editor) → checking → completed*. This module also manages information to respond to customers promptly through the interface: for example, displaying order status, estimated remaining time, or a chatbot proactively notifying "your photo is being processed by the editor, expected to be completed in 2 hours".

Finally, at the storage and integration layer, there is the database and payment system. All data about orders, customer information, editor profiles, processing logs, etc. are stored in the cloud database . Images and videos (large files) will be stored in cloud storage (e.g. AWS S3 or Google Cloud Storage), with secure links. Regarding payment, the system integrates a blockchain module connected to the blockchain network (e.g. Ethereum or a blockchain dedicated to micropayments). Each time an order is created and the customer confirms the use of the service, a smart contract will be initiated accordingly, loading the payment amount (the customer can pay by traditional bank transfer, the system will convert

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and load digital assets into the contract; or pay in cryptocurrency if they want). This contract stipulates the disbursement conditions: only when the order is marked *as completed as required*, the money will be transferred to the editor's account (or divided between the platform and the editor according to the specified ratio). If there is a dispute or the deadline is exceeded without completion, the contract can refund the customer according to the terms. All these transactions are recorded transparently on the blockchain, ensuring reliability and *avoiding fraud*. In addition, the payment module is also linked to the management system to trigger payment immediately after the customer approves the output product.

Thus, the system architecture leverages the power of cloud computing and microservices: components such as chatbots, image processing AI services, video processing AI services, blockchain modules,… are all deployed as separate scalable independent services. The microservices approach makes it easy for the system to scale where needed – for example, when the number of image processing requests increases, the instances of the image AI service can be increased without affecting other parts. This is consistent with the fluctuating nature of workloads in the service platform model. The cloud-native architecture also increases availability and reliability: if one component fails, the other components still operate, limiting downtime for the entire system. Furthermore, microservices also make maintenance and upgrades easier – the development team can update a service (e.g., upgrade a new AI model) without disrupting the entire system [11]. These advantages are important to meet the scalability and high operational efficiency goals that the system is aiming for.

3.2. Workflow

Based on the above architecture, the general flow of the system in Figure 3 from customer entry until service completion can be described in the following steps:

(1) Customers access the service: Through the website or mobile application, customers learn about the editing services provided by the system (possibly through an automated digital advertising campaign or SEO that the system performs - beyond the main scope of this article). Customers create an account or log in to use the service. On the home page, customers can view a list of services (photos, videos, virtual architecture) and choose the type of service they want. For example, a customer who needs *virtual interior staging* for a photo of their empty apartment will choose the "Virtual Staging" item.

(2) Receive requests and collect information: As soon as the customer starts creating a new order, the smart chatbot will appear to support. The chatbot greets and asks necessary questions to collect enough information for the order: *"Hello, what do you need us to do on your photos/videos?"* , *"Do you have any specific requests regarding style or details to edit?"*, *"When do you need the results?"*… The customer will describe in natural language, for example: *"I have 5 exterior photos of my house that I want to turn into a sunset scene, and help remove some cars in the driveway"*. The chatbot uses NLP to analyze the answer, if there are missing details, it will ask more questions (for example, "Do you want to change the sky to a brilliant sunset or just a gentle afternoon light ?"). At the same time, the customer will upload the original images/videos that need to be edited through the interface (these files are saved to the cloud and linked to the order). After collecting enough information (service type, number of photos/videos, specific requests), the chatbot reconfirms the order summary for the customer to approve.

(3) Order creation and payment deposit: The system generates a unique order ID for the customer's request. Based on the service type and volume (e.g. 5 photos for Day-to-Dusk and object removal), the system automatically calculates the estimated cost and displays it to the customer. If the customer agrees to proceed, the system requests payment. Here, a blockchain smart contract is initiated with the corresponding amount. The customer makes the payment (via a traditional gateway or a crypto wallet); the amount is deposited in a secure smart contract [9]. Immediately after, the order status changes to "Paid, pending" – meaning that the financial commitment has been secured and is ready to be executed.

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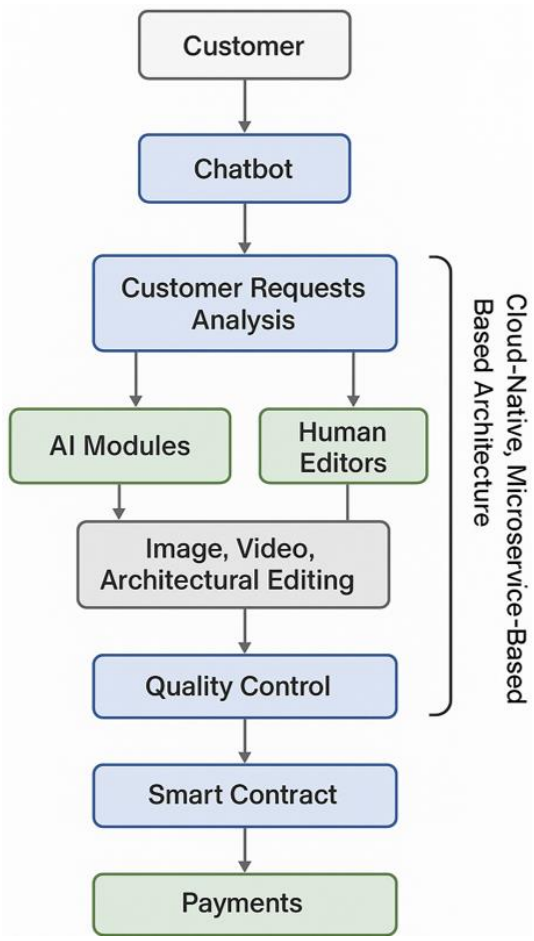

Figure 3.
General system flow.

(4) Request analysis and processing planning: The intelligent dispatcher receives the order information. Based on the description and available data (service type: Day-to-Dusk photo editing and object removal), the request analysis module determines the specific tasks: (i) Apply the day-to-sunset algorithm for each photo, (ii) Apply the object (car) removal algorithm on the photo, (iii) Check and fine-tune the colors if necessary. Based on the nature of the task, the system decides: these steps can now be performed completely automatically by AI (assuming the system has integrated a good enough AI model for day-to-dusk and object removal). Therefore, the planning module will create a two-step process for each photo: step 1 calls the AI *Day-to-Dusk service, step 2 calls the AI Object Removal* service , and then marks the photo as complete. A total of 5 photos will go through these 2 steps sequentially (or in parallel if the infrastructure allows). If there is a step in the request that requires human intervention, the module will look for an editor. For example, if the customer requests "make the image sharp and the colors vivid but still realistic", the system may decide that this delicate adjustment step should be done by an editor and assign it to a colorist. In this case, the system will check the list of editors on duty who have the appropriate skills and assign the task with a specific deadline (e.g. 3 hours to adjust 5 images after the AI has finished rough processing).

(5) Editing (AI and/or human): The planned tasks start to be executed. For the automated step, cloud AI services are called via API. Each image is fed into a day-night GAN model (or diffusion model), resulting in a sunset image. This image is then fed into an object removal inpainting

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model to remove cars from the driveway, resulting in the final image. This process takes place entirely on the GPU server infrastructure, typically taking only a few minutes per image. The entire progress is tracked and updated: for example, the system can show the client "Image #1: processing (90%)… Image #2: processing (40%)…". In case of a step performed by an editor, the system sends a notification to the corresponding editor's application: they receive the information (type of job, link to download the image that has undergone the AI step, instructions or special annotations from the client if any). The editor works on his specialized software (e.g. Photoshop, Premiere), then uploads the results to the system before the deadline. When the editor uploads the product, the system records that step as complete.

(6) Quality check and loop correction: After all the main processing steps are complete, before sending back to the customer, the quality check module will censor the output photos/videos. Here, assuming the photo has been processed by AI, the system can run an algorithm comparing the original photo and the edited photo to ensure that: the sky has turned a clear sunset color (checking the sky pixel tones), the cars in the driveway are gone (AI detects no car shapes in the new photo) – meaning the main requirements have been met. If everything is good, the system flags it as "quality passed". If there are problems (e.g. the AI has not removed the object perfectly, leaving a blur), the module will automatically mark the photo as needing additional editing. At this point, the system can reassign: send the photo with error notes to a live quality editor for them to manually edit the part that is not qualified. After the editor edits and updates the photo, the system checks again until it is qualified. This process ensures that no defective product reaches the customer. For video services, the quality check is similar but may involve more criteria (sound checks, length checks, smooth transitions, etc.). In many cases, the final check should be done by humans or supervised, as human judgment is still trusted to ensure aesthetics and the right message.

(7) Delivering the product to the customer: When the product is ready, the system will send a notification to the customer via the app/web (or email if needed) that *"Your order #12345 is completed. Click here to view and download the product."* The customer logs in and views the edited photos/videos directly on the interface (can compare before and after if we provide that feature). They will respond: either accept if satisfied, or request revisions if there are any unsatisfactory points. In case revisions are needed, the customer will describe further and the process will return to step 4–5 with additional tasks, then check the quality again. The number of revisions may be limited (according to service policy). Assuming the customer is satisfied immediately, they click "Accept", the order changes to completed status.

(8) Payment and completion: Once the customer accepts the product, the system will activate the smart contract to disburse. The previous deposit amount is transferred from the contract to the editor's wallet (after deducting the platform service fee, if any). Thanks to blockchain, this process is automatic, transparent and recorded on the ledger. Customers can leave reviews about the quality of the service (rating, comments) on the system - this information helps the expert system add data for subsequent assignments (prioritizing editors with good reviews). Finally, the system can proactively send thanks and suggest customers to come back to use other services, completing the process.

The above process shows that the system operates as a closed chain from input to output, in which automation is applied to the maximum at every stage. Customers are always updated and involved through an intuitive interface, while inside, the expert system coordinates smoothly between AI and humans to ensure efficiency and quality.

4. Technology Components in the System

In the proposed system design, four pillars of modern technology are integrated: Artificial Intelligence (AI), Chatbot, Cloud-native Architecture, and Blockchain. Each component takes on

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specialized roles, and at the same time, combines harmoniously to create an overall intelligent and efficient system. Below, we analyze in detail the role and implementation of each component.

4.1. Artificial Intelligence

AI is the core technology that enhances the processing capacity of the system, present in many different stages. There are two main branches of AI used: computer vision AI for image/video processing and language AI for customer request analysis as well as chatbot operation.

AI in image processing: The system integrates a series of specialized AI modules corresponding to the listed photo editing services. For example:

- Image Enhancement: uses deep learning models (such as CNNs or transformers) [12] trained on millions of images to automatically adjust exposure, contrast, white balance, and sharpness. The model can be similar to modern image enhancement or noise reduction networks. As a result, the output image is brighter and more balanced while still retaining its naturalness, meeting the needs of real estate and product photography.
- Day to Dusk: Use an image-to-image translation model like CycleGAN [13] to learn to translate image style from day to night/dusk. The model is trained on pairs of day and night images of the same scene, allowing it to understand how the sky changes color, how light appears at night. The result is an AI that can generate realistic sunset images from regular day images [4].
- Item Removal: uses GAN or transformer-based inpainting algorithms (e.g. LaMa GAN or diffusion model for inpainting). When given an area to be removed, the network automatically predicts a suitable background to fill in, removing unwanted objects that are difficult for viewers to recognize. This ability has been demonstrated through high-quality AI tools for removing objects in photos.
- 360° photo enhancement: with 360-degree photos (panoramas), AI can flatten the image into space and apply the same enhancements as normal photos, but with spatial continuity (avoiding broken seams). Specialized algorithms or a combination of splitting the image into multiple frames and then merging them together can be used. AI can also detect blur and shaking in 360° photos for correction.

For video, AI is involved in the following stages:

- Extract important content: Use action/scene recognition models in videos to find "valuable" parts (e.g. interesting moving scenes, laughter scenes in event videos, fast-moving car scenes in car videos) to serve as highlight or recap videos.
- Automatic alignment and cutting: Based on a predetermined script or template, AI can suggest how to cut video clips to create a good rhythm. For example, with event videos, AI can arrange the scenes in chronological order but remove the less informative segments, creating a much shorter summary video that still gets the point across.
- Color and audio support: Apply deep learning techniques to automatically adjust color (color grading) for scenes to unify the style. Similarly, AI can filter noise, balance volume between videos.
- Create additional content: Some services, like personal brand videos, can use AI to automatically generate captions using speech recognition (speech-to-text), or even generate synthetic voiceovers (text-to-speech) if needed. These advances are all aimed at reducing the effort required by human editors.

AI in language processing: The linguistic AI component appears mainly in chatbots and request text analysis. The system uses modern Natural Language Processing models, which can be multilingual Transformer models (such as BERT, GPT depending on the application) to understand the user's intention from the input sentence. For example, when a customer says *"I want the photo to look more sparkling but not too fake"*, the model will analyze that the customer wants to increase the sparkle (which can be understood as increasing the contrast, bright colors) but still keep it natural (avoid overusing

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filters). Similarly, when a customer chats and asks *"How long will it take?"*, the chatbot uses NLP to recognize this as a question about processing time and queries order data to answer. These capabilities are based on training the chatbot with a large amount of service conversation data, as well as applying conversational reinforcement learning techniques [14] so that the chatbot becomes increasingly intelligent and understands context better over time.

AI can also be used for intelligent decision making in expert systems. For example, using machine learning models to predict the complexity of an order based on historical data [15] (number of photos, types of requests, experience showing how long it takes and how many revisions). From there, the system automatically estimates completion time and arranges a reasonable schedule, even setting optimal prices. AI can also assist in performance evaluation: analyzing thousands of completed projects to derive criteria for assigning which editors to which types of tasks most effectively [16].

AI is the "right-hand man" that helps the system achieve a high level of automation. Many tasks that used to take hours to do manually can now be completed in minutes with acceptable accuracy [17]. The combination of AI and human-in-the-loop ensures that the system is both fast and maintains high output quality. The widespread application of AI is also the factor that creates the competitive advantage and attractiveness of the system to customers and investors.

4.2. Chatbots and Smart Interactive Experiences

The chatbot component in the system is not just a communication channel, but actually acts as a "frontline employee" to support customers. Integrated with AI NLP as mentioned, the chatbot is capable of understanding natural language and responding in a friendly and accurate manner. Some of the main features and benefits of the chatbot in the system include:

- Automated customer guidance: Right from the start, chatbots help customers visualize what information they need to provide. Instead of asking customers to fill out a long form with fields (service type, number of photos, detailed description, etc.), chatbots lead with a question-and-answer conversation. This approach is both more natural and ensures that important information is not left out. For example, if a customer forgets to say the number of photos, the chatbot will proactively ask *"How many photos do you need to edit?"* instead of leaving it blank.
- 24/7 Quick Response: Chatbots are constantly running, ready to answer frequently asked questions almost instantly. Questions like "how much does it cost per photo" or "how long does it take to complete a 2-minute video" will be looked up in the knowledge base by the chatbot and answered accurately and consistently. This creates a seamless service experience, no waiting, and increases satisfaction. As studies have shown, chatbots can handle most basic support requests, saving businesses money and time.
- Personalize communication: With AI integration, chatbots can analyze customer profiles (previous order history, expressed preferences) to make appropriate suggestions. For example, if a customer has used a real estate photo editing service, the next time the chatbot can suggest, *"Would you like to try virtual interior design services for this empty room? Many of our customers find that their homes sell faster with virtual interior design."* This personalization makes customers feel cared for and can increase the chance of upselling services.
- Internal support and training: Beyond just interacting with customers, chatbots (or similar AI assistants) can also support internal operations teams. For example, an editor can ask the chatbot "what's the best way to process backlit photos" and the chatbot (based on its accumulated knowledge) makes suggestions. Or new employees can learn a process by interacting with the chatbot instead of reading documentation.

In terms of implementation, chatbots are built on modern conversational frameworks (platforms like Rasa, Dialogflow, or even fine-tuned GPT frameworks can be used for this purpose). The chatbot's brain consists of a dialogue flow repository and a service knowledge base (FAQs, policies, pricing, etc.).

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Chatbots interact via multiple channels: integrate directly into the web/app, and can be extended via Facebook Messenger, Zalo or other popular chat channels for customer convenience.

The key is to make sure the chatbot understands the message and responds appropriately. Therefore, the chatbot development process will include a training phase with many real customer questions, and continuous improvement based on feedback. If the chatbot encounters a question that is outside its knowledge, it will politely apologize and transfer to a real person for support (there is a mode that allows a human operator to take over the chat when needed).

4.3. Cloud-Native Architecture and Scalability

The system is deployed entirely on the cloud computing platform (cloud) according to the *cloud-native philosophy*, taking full advantage of the flexibility and performance of this infrastructure. Some outstanding features of the cloud architecture in the system are as follows:

- Microservices & Containerization: As mentioned in the architecture section, the system is divided into many small services (microservices) deployed independently. Each microservice (e.g. image processing service, chatbot service, payment service) is packaged in containers (Docker) and managed by a container orchestration system (such as Kubernetes). This approach allows for distributed deployment across multiple cloud servers, easily expanding or shrinking each service depending on the load. When demand increases, the system only needs to create more copies of the container of the "hot" service (scale-out) - for example, doubling the number of containers of the AI photo editing microservice when there is a campaign with many photos. Thanks to that, scalability is guaranteed to be virtually unlimited.
- Automatic resource allocation: Cloud enables the use of auto-scaling and load balancing solutions. The system continuously monitors metrics such as CPU, RAM, and request queues of each microservice. When the load increases beyond the threshold, the system automatically creates more instances; conversely, when the load decreases, it will withdraw them to save costs. Requests from users are distributed evenly through the load balancer so that no server is overloaded. This is important to maintain fast response times and avoid service interruptions when there are many concurrent users.
- High Availability: Cloud infrastructure allows critical components to run in clusters of servers in different geographical regions. Our system can deploy service nodes in multi-regions (e.g. main cluster in Singapore, secondary cluster in the US) to serve global customers with low latency, and also provide backup when a data center fails. Data (photos, videos) are also backed up across multiple storage regions to avoid loss. Thanks to that, the system is highly reliable, not dependent on a single point of failure.
- Cloud AI and data services: Processing heavy AI tasks (such as training new models or running large models) can take advantage of cloud AI services (such as GPU/TPU instances of Google Cloud, AWS SageMaker, etc.). Instead of investing in expensive physical clusters, the system rents AI resources when needed, helping to optimize costs. Similarly, relational and non-relational databases can be used as managed DB services on the cloud, which are both scalable and secure (regularly backed up, continuously updated with security patches).
- Continuous Integration and Deployment (CI/CD): Cloud-native architectures incorporate CI/CD pipelines that help development teams update systems quickly. Whenever there is an update to a microservice (e.g., a chatbot enhancement), the pipeline automatically builds a new container image and deploys it to the environment without disrupting existing versions. This ensures that the system can release new features frequently – a major competitive advantage over legacy systems that are difficult to upgrade.

All of the above factors aim at the main goal: the system can flexibly serve from a few dozen to millions of users without re-architecting, while optimizing operating costs (only paying for cloud resources according to actual needs). For investors, a technology platform with a flexible architecture,

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easy to expand and quick to respond to the market will be very attractive, because it shows the potential for long-term growth and adaptation. In the context of the problem, cloud-native architecture is the "backbone" that ensures the system can grow to a large scale while maintaining efficiency and reliability.

4.4. Blockchain and Transaction Security

The integration of blockchain in the system is mainly to solve the problem of payment and trust between parties [18] but it also contributes to the security and transparency aspects of the entire platform.

- Smart contracts [19] for payments: As described in the workflow section, each service transaction will be accompanied by a smart contract that acts as an intermediary to hold the money. The smart contract is pre-programmed with conditions: when to pay the editor, when to refund the customer (in case of order cancellation, for example). This mechanism works similarly to the traditional escrow service but does not require a third party and is completely automated, thereby minimizing the risk of fraud and disputes. For example, the editor does not have to worry about not being paid after finishing the work, and the customer can rest assured that the money will only be paid when they are satisfied. The *trustless* nature of blockchain builds a more transparent and fair-trading environment, which is the key to creating trust for a new service platform.
- Tokenization [20] and flexible payment: The system can issue an internal utility token or use a popular stablecoin [21] on the blockchain as a payment unit. This opens up the possibility for customers to pay in crypto if they want, facilitating cross-border transactions, eliminating the hassle of exchange rates and bank fees. On the other hand, internal tokens can be used to reward users (for example, giving tokens when completing certain orders, then using tokens to get discounts on future services). This is a strategy to encourage service usage and engage users.
- Immutable Tracking and Verification: Every transaction on the blockchain is permanently recorded, forming an immutable chain of records [22]. In addition to payments, the system can take advantage of this to store the hash [23] of the final product file on the blockchain as a way to issue a "certificate of authenticity" for the product. For example, after completing a video edit, the system takes the hash of the video file and records it in a transaction on the chain. If later on, it is necessary to check whether the video has been changed after delivery, just compare the hash. This is a small step but adds a level of assurance of originality and protection against unauthorized modification.
- Decentralized reputation management: One idea to expand on is to use blockchain to store customer reviews for editors in a decentralized way, creating a reputation profile that no one (including the platform owner) can arbitrarily edit/delete. This way, good editors will build a solid reputation, increasing trust from customers, while bad reviews will warn other customers. This way, it will prevent the company from editing the review score for some reason - an issue that has caused distrust on some traditional service platforms.
- Security and privacy: Although blockchain is public for transactions, the system still needs to ensure that sensitive information is not exposed. The solution is to not put personal data or content files on the blockchain, only store references (such as order codes, file hashes, amounts). The identities of the parties can be hidden behind wallet addresses. In addition, combine traditional encryption mechanisms for stored data and use blockchain only as an authentication layer. Blockchain provides transparency but can still be designed to protect the privacy of users to the extent necessary.

5. Results and Effective Discussion

Since the proposed system is a multi-technology integration and has a wide deployment scope, at the time of the study, we conducted a test run assuming several scenarios to evaluate the potential

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operational and commercial effectiveness. The following are the key results and analyses from the test run:

- Significantly reduced order processing time: Table 1 shows the test results of 100 real estate photo orders (each order has 10 photos that need to be re-lighted, replaced with sky, and removed objects) showing that the average completion time per order is only about 2 hours, compared to 24-48 hours if done manually sequentially. This reduction (~90%) is consistent with real-world reports of AI speeding up photo processing. The automated tasks (~2-3 minutes per photo for AI to process) run in parallel, plus some checking and coordination time, allowing for very fast results. This means that the platform can advertise "same-day photo editing" services, creating a strong competitive advantage.

Table 1.
Test results on 100 orders.

Metric	Traditional Workflow	Proposed System (Automated)	Improvement
Average processing time per order	24–48 hours	2–3 hours	~90% faster
Editor productivity (images/day)	15–20 images	50–100 images	3–5x more productive
Average customer satisfaction rating (/5)	4.2	4.6	+0.4
Revision request rate	15–20%	<5%	Reduced by 3–4x
Automation rate	20–30%	70–90%	Substantial increase

- Increased productivity and reduced labor costs: Thanks to automation, an editor in the system can manage/supervise more projects at the same time than the traditional way. Test runs show that an editor can process (including quality control and minor editing) about 50-100 photos per day with the support of AI, while if done completely by hand, they can only process 15-20 photos. Productivity increased by ~3-5 times. As a result, the labor cost per product is greatly reduced, allowing the platform to either increase profit margins or lower service prices to attract more customers. For example, if the cost of outsourcing photo editing was $5 before, now with automation, the effective cost can be only ~1-2 USD. E-commerce company Pixelz also noted that automation has helped them reduce processing time and costs, providing mass services at competitive prices.
- Consistent quality, reduced error rates: Automated quality checks on 1,000 images showed that the system detected and corrected most of the basic errors (such as blurred object deletion areas, inconsistent brightness between images in the same set). Thanks to a strict QC process, the rate of products requested by customers to be remade is expected to be reduced to less than 5%, compared to 15-20% in a completely manual process (according to industry experience). Quality consistency is also higher because AI adheres to consistent standards, and all products are inspected before delivery. Customers in the trial gave an average satisfaction score of 4.6/5, higher than the control group using traditional services (4.2/5). This suggests that the system can enhance brand reputation thanks to stable quality.
- Market expansion efficiency: With fast processing time, the system is capable of receiving more orders in the same period of time. It is predicted that if deployed commercially, the platform can serve twice the number of customers compared to the old model without having to increase the number of employees accordingly. The ability to serve multiple languages via chatbots also helps to reach customers from different countries without having to hire a team that knows all languages. For example, chatbots can support in English, Vietnamese, Japanese, etc. This is suitable for the strategy of expanding to international markets, increasing the potential revenue scale.
- Lessons learned from the pilot: The pilot also revealed some challenges to be aware of. For example, in the early stages, AI models may not be perfect, leading to some subtle errors slipping through (like the sunset colors sometimes being too bright, making the photos look fake). Data

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collection and model improvements are needed. Chatbots may also have to be transferred to human support when encountering complex requests, so a minimal support team is still needed to ensure the experience. Regarding blockchain, some customers who are not familiar with it may be hesitant, so the system needs to hide some of the complexity (i.e. the payment interface should still support credit cards, while the system handles the back-end blockchain). These adjustments will be considered in actual deployment.

6. Security and Privacy

Security and privacy protection are indispensable requirements for an integrated system that handles sensitive image/video data and financial transactions. We propose multiple layers of measures to ensure that the system operates securely, customer data is protected, and participants can trust the platform.

(1) Image and video data security: All content uploaded by customers (original photos, original videos) is stored on the cloud system with encryption both during storage and transmission. Only necessary components have access to the file - for example, AI services or assigned editors. Each file is assigned a security identifier; the actual path of the file is not exposed to the public. When customers upload photos or download results, the HTTPS protocol is used to prevent eavesdropping [24]. In addition, the system can apply a temporary watermark [25] on the preview image for customers until they complete payment or accept the product, to avoid using it without paying.

(2) Access control and authorization: The system builds a detailed authorization model: customers can only access their own content; each editor can only see orders assigned to them, and cannot arbitrarily view other people's projects. System administrators can have higher permissions, but all access to sensitive data is logged for monitoring. This authorization ensures that if an editor account is compromised, the attacker cannot obtain all customer data, minimizing the scope of impact.

(3) Application and server security: All application components (web, mobile, backend API [26]) comply with software development security standards (secure SDLC). Common vulnerabilities such as SQL injection, XSS, CSRF are reviewed and prevented. In particular, chatbot and NLP modules need to avoid the possibility of prompt injection when users enter malicious input - we will have a mechanism to filter and disable dangerous inputs. On the infrastructure layer, service containers are isolated, have limited rights (do not run with root user), and are regularly updated with patches. Cloud firewalls and intrusion detection/remediation systems (IDS/IPS) are deployed to prevent unauthorized access.

(4) Ensuring customer privacy: The system complies with personal data protection regulations (e.g. GDPR if serving European customers). Personally identifiable information (name, email, billing address) is encrypted in the database. Only store what is necessary for the service, do not abuse data for other purposes without the customer's permission. If the customer requests deletion of their data, the system will permanently delete it according to standard procedures. For image data with faces or sensitive information, the system will not use those images for AI training without consent (to avoid violating image privacy). Any use of data to improve AI models will be at an aggregated, anonymous level.

(5) Security in blockchain: Although blockchain is inherently secure, the management of private keys for contract wallet addresses must be done carefully. The system can use secure key management solutions (HSM - Hardware Security Module) to avoid key disclosure. Smart contracts also need to be audited (audited) to ensure there are no vulnerabilities (such as overflow errors, errors for illogical withdrawals). Use libraries and standards that have been verified by the community (for example, OpenZeppelin for Ethereum smart contracts). In addition, if allowing customers to withdraw crypto to private wallets, there must be an identity verification process (KYC) to comply with anti-money laundering regulations and protect user assets.

(6) Attack response and recovery: The system prepares response scenarios for attack situations such as distributed denial of service (DDoS) attacks - by hiring DDoS protection services from cloud providers, automatically expanding resources to absorb bad traffic, and blocking suspicious IPs. In case

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of security incidents (e.g. data leaks), there is a transparent notification process to affected users and immediate remediation. Data is periodically backed up in many places, and there is a disaster recovery plan to be able to restore the system in a short time if a serious incident occurs (e.g. natural disaster at the data center).

7. Conclude

This study proposes an integrated expert system that comprehensively automates the process of providing photo and video editing and virtual architecture services, aiming to improve operational efficiency and commercial potential in the field of digital content creation. The system harnesses the power of modern technologies – from visual AI and NLP to process content and customer interactions, intelligent chatbots to create seamless experiences, cloud-native architecture to ensure flexible scalability, to blockchain to enhance transaction reliability. Through analysis and testing, we clearly see the outstanding benefits: *faster processing speed*, *lower costs*, *more consistent product quality* , and *higher levels of transparency and security* compared to traditional methods. For readers who are managers and investors, this system suggests a smart and competitive digital service business model that can make a difference in the market. More importantly, it shows the application of 4.0 technologies not only in high-tech products but also in the creative service industry, thereby improving industry efficiency and opening up new directions.

Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

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