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INTEGRATING AI TECHNIQUES IN 3D VIRTUAL WORLDS THROUGH HEAD-MOUNTED DISPLAY VR SYSTEMS

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ABSTRACT
The potential of artificial intelligence (AI) continues to expand as the technology becomes more prevalent. Increasingly, AI research focuses on various forms of collective intelligence, with robot simulations, both hardware and software, aiding researchers in understanding human and societal group dynamics. This study utilizes the HTC Vive as the primary head-mounted display (HMD) for a proof-of-concept virtual reality (VR) environment. At the conceptual design stage, users can create full-scale, 3D product geometries within this environment. Similar to natural sciences, modeling plays a crucial role in social sciences, helping to unravel how complex systems can emerge from simple initial conditions. Users can modify full-scale geometries by adjusting the relevant Walkthrough Interactive Model (WIM) components, allowing them to edit designs effectively. The VR application described in this study enables users to quickly generate, evaluate, and visualize conceptual 3D ideas without the constraints of traditional software. This paper proposes a novel tourism simulation utilizing artificial neural networks (ANN) and the Mount Headed Design algorithm, aiming to innovate the tourism sector by leveraging advanced AI techniques and VR technology to enhance user experience and operational efficiency.

Keywords: Artificial intelligence, E-Learning, Blended Learning, 3D Virtual Worlds, Teaching Learning Innovation.

I. INDRODUCTION
By "artificial intelligence," we mean computer-based robots that can do tasks normally performed by humans. In artificial intelligence, computers carry out activities such as voice recognition, problem solving, learning, etc. With enough data, machines can mimic human performance and behaviour. Therefore, knowledge engineering is very important in the field of artificial intelligence. To use knowledge engineering, it is necessary to establish the connection between things and their characteristics. Various AI methods are outlined here.

Techniques of Artificial Intelligence: There are several subsets of AI, distinguishable by whether or not the machine has a memory, can learn from its mistakes, or can think for itself. IBM developed Deep Blue, a chess software with piece recognition. However, it lacks the cognitive capacity to anticipate human behaviour. Even if it's helpful, this system can't be modified for usage in a different setting. Another kind of AI that learns from its previous mistakes and utilises that information, plus the benefit of a smaller memory, to make future predictions.

Logical AI: Everything a programme knows both about the world in general and the particular scenario in which it must act as well as its objectives, are expressed as sentences in some mathematical logical language. The computer makes choices based on its own inferences about what it needs to do to reach its objectives.

Search: Many AI algorithms, whether they be chess engines or theorem provers, will consider a vast array of alternatives before making a decision. More effective methods for doing this are always being discovered.

Pattern Recognition: For most computer programmes, the next step after making an observation is to check that data against some kind of template. To identify faces in a scene, a vision software may, for instance, look for recurring shapes that resemble eyes and noses. More intricate patterns, such as those seen in a chess position, a natural language text, or the evolution of an event, are also investigated.

Representation: There must be a method to visually express the world's facts. The usual tools for this job are the languages of mathematical logic.

Inference: Certain inferences may be drawn from known data. While mathematical logical deduction may serve certain needs, the field of logic has advanced significantly since the 1970s with the addition of non-monotonic inference techniques. Default reasoning is the simplest kind of non-monotonic reasoning, in which a conclusion is to be inferred by default but may be revoked if evidence to the contrary is shown. If we hear about a bird, we could assume it has the ability to fly, but if we learn that the animal in question is a penguin, we might draw the opposite conclusion. One indication of the non-monotonic nature of the reasoning is the potential for reversal of a previous conclusion. The number of possible inferences from a given set of premises is a monotonically growing function of the premises in standard logical reasoning.

Common Sense Knowledge and Reasoning: Although it has been a focus of AI research since the 1950s, this is the domain in which the technology is now the farthest from human competence. Even though there has been a lot of progress, for example in creating systems of non-monotonic reasoning and theories of action, there is still a pressing need for even more novel approaches.

Learning from Experience: This is the job of the programme. Methods of artificial intelligence built on connectionism and neural networks excel at this. Logic-based legal study is another option. Unfortunately, learning systems are virtually all predicated on relatively restricted capacities to describe information, thus programmes can only learn what facts or behaviours their formalisms can express.

Planning: Data about the world at large (particularly facts about the impacts of actions), specifics about the situation at hand, and an explicit objective are the building blocks of every program's plan. This is when the plan to get there begins to take shape. Typically, a strategy is nothing more than a plan of action.

Epistemology: The several types of information that must be mastered to address global issues are the focus of this research.

Ontology: Understanding the different types of objects in the world is the focus of ontology. Studying the types of objects seen by AI algorithms and phrases, as well as their fundamental characteristics, is an important area of research. In the 1990s, ontology became a focus of study.

Heuristics: In computer science, a heuristic is a method for finding a solution or hidden information. There is no one definition of the phrase within the field of artificial intelligence. Some search strategies use heuristic functions to determine the level of confidence in the proximity of a given node in the search tree to the target. Heuristic predicates may be more helpful if they compare two nodes in a search tree to determine which is superior, i.e. whether or not it moves the search process closer to its ultimate aim.

Genetic Programming: By randomly pairing two Lisp programmes and choosing the most successful offspring across many generations, genetic programming is able to produce programmes that can solve a problem.

3D Virtual World: 3DVW is different from other computer programmes since it is intended to be used in a wide variety of contexts. Real-time photography and audio recording allow for the creation of audio-visual datasets that may be utilised for training and testing learning and prediction mechanisms in both humans and neural networks. The scene's interactions may also alter them. Additionally, several robot and avatar varieties may be programmed to think and act in a controlled simulation. In addition, VR may be used to collect ground-level information on how people in the vicinity pay attention to and engage in play.

The Role of AI in Virtual Worlds: Keep in mind that despite certain similarities, virtual worlds and the virtual reality stated previously are really very distinct ideas [7]. The fact that the majority of the user's impression originates from the images presented on the computer monitor is a key distinction between MUVEs and older virtual reality approaches.

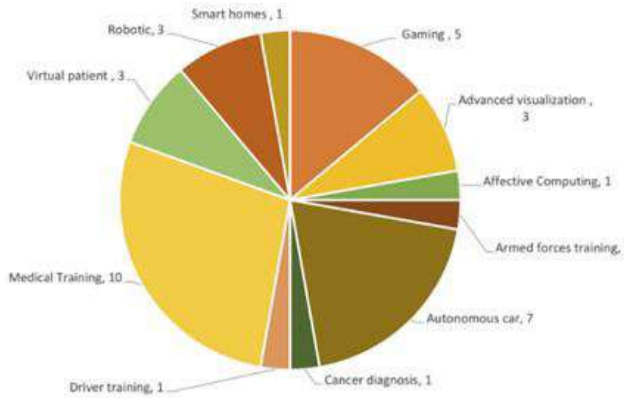

Fig 1: Virtual Reality and the Role of Human Intelligence

- Virtual reality technology has been widely implemented due to its steady advancement. It has achieved strides not just in the military but also in trade, education, and healthcare. New interface tools for intelligent engineering are becoming available with the development of VR technology.
- Virtual reality technology can not only deepen the understanding and understanding of some internal connections, but also effectively promote the development of geology. This is because it has created a new field for human-computer interaction interface, realising large-scale visualisation of various projects.

1.1 ISSUES OF 3D Virtual World

3D Recontruction

- One of the key issues in the 3D modeling of virtual geology is the manifestation of its irregularfeatures.
- Experts built a three-dimensional terrain structure by using a digital elevation model.
- Digital elevation model technology is widely used today, and we can use this technology to visualize 3D terrain.

There are several steps involved in the establishment of a digital elevation model. The first point is the generation of digital raster maps.

- Scanning of topographic maps. The purpose of thisis to obtain a digital raster map.
- Correct the raster map we got to eliminate errors caused by paper deformation or some other factors.
- Acquisition of elevation information. In fact, the so-called elevation information is to be processed digitally on the obtained raster map, and the generated elevation information is necessary for the establishment of a digital elevation model

1.2 LINK BETWEEN THE ONLINE AND OFFLINE WORLDS

Over the last several years, we've seen a convergence between the online and offline worlds. In order to maximise efficiency, the production and consumption of materials were split out during the First and Second Industrial Revolutions. In the Third Industrial Revolution, as more and more business is performed online, data has emerged as a precious commodity, and traditional offline methods of doing business are being phased out.

As technology advances and the gap between machines and people widens, the Fourth Industrial Revolution is giving way to a revolution of intelligence. It is possible for manufacturing and consumption to occur simultaneously, as in social customisation or digital do-it-yourself (Design It Yourself). Pareto's law, which seeks to own and focus on the core 20% owing to limited resources, is the dominant force in the offline world made of materials. In contrast, the Long Tail hypothesis is used in the digital sphere to disseminate knowledge and mine possibilities among the untapped 80% of consumers.

As we go towards the Fourth Industrial Revolution, we are entering a convergence environment in which the internet and offline worlds merge. Manufacturing, logistics, finance, automobile, sports, healthcare, education, food, and daily life are all merging in this way. In addition, a new convergence between the offline world and the online world is being created as a result of the problems of material production and supply being solved in the First, Second, and Third Industrial Revolutions and an increased interest in human personal desire and spirit in the Fourth Industrial Revolution stage.

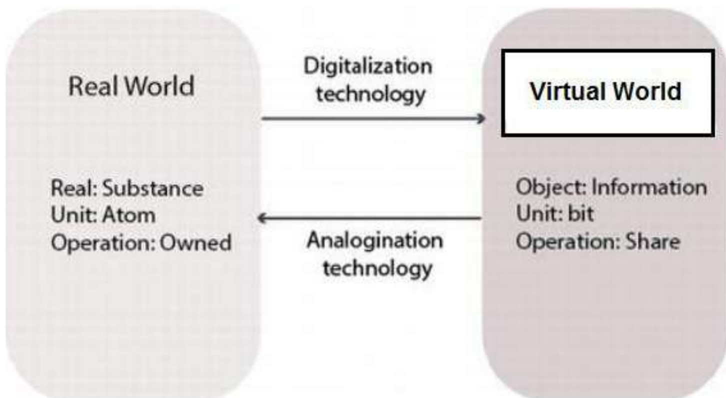

Fig 2: Real World vs Virtual World

Confidence in Virtual Information

The expansion of the virtual world has paralleled the Fourth Industrial Revolution. Data from the virtual world has been used to represent the actual thing, and the virtual world has even guided the real world. In this case, the accuracy with which the actual object is being translated into data in the virtual world is called into doubt. As more and more transactions take place online, building confidence in virtual systems is becoming more crucial. One such trust technology is the blockchain.

It is possible for every node in the network to produce blocks, but only one of these blocks will be recognised and linked to the rest of the network. Consensus among participating nodes to choose one block is crucial since only one block from multiple blocks is linked to the previous block and the rest blocks are deleted. Proof-of-Work (PoW) and Proof-of-Stake (PoS) are examples of consensus methods used to obtain a group decision. The node that generates a new block may be rewarded with bitcoin if all the other nodes agree that it is a valid addition to the blockchain. This process is known as mining, and a blockchain consisting exclusively of blocks generated via mining is known as a Canonical Chain.

II RELATED RESEARCH WORK

Bainbridge, William Sims, et al (2007), This article introduces numerous study approaches that scientists are actively researching using the popular virtual worlds Second Life and World of Warcraft as examples of current virtual worlds that predict future advances.

N.yee et al. (2006) looked at how subjective judgements of presence, copresence, simulator sickness, and entitativity changed over time, as well as how nonverbal behaviour and task performance on verbal tasks were affected. In addition, we looked at two forms of social interaction that have undergone radical change: nonverbal imitation and facial likeness. As participants got more used to the system, there were clear improvements in several areas, including task performance, subjective evaluations, nonverbal behaviour, and simulator sickness. Moreover, modifying an avatar's appearance to boost face likeness occasionally resulted in better task performance. The ramifications for future studies of CVEs are discussed.

References: C. W. Thompson et al (2011), This article describes research on using a single viewer to access several 3D virtual environments. The work modifies the RealXtend Tundra client viewer's communication architecture and memory management such that it can maintain several logical connections at once. In order to curb memory waste, a 'area of interests' based system of memory management was implemented. The user interface was updated to include "tabs" for quick navigation between different settings. Experiments reveal that the volume of network traffic grows according to the size of the corpus of text being sent, indicating the necessity to adjust protocol settings to limit the volume of data travelling across inactive connections. The memory management system works well enough to keep the GPU's memory use where it should be.

"N. Yannakakis et al" (2012), In this article, we outline four primary game AI research fields that are plainly redefining the game AI term and transforming the research agenda in the field. Computational user experience modelling, content production through generative methods, large-scale player data mining, and alternate AI research focuses for boosting NPC abilities are all examples of "flagship" study topics in the field of game AI.

Using robotics, AI, and VR, this action research project will develop a virtual application and on-the-job training materials for English tour guides (Chen et al., 2021). It is crucial to provide teachers with training to assist them investigate the potential presented by technology advancement in education as well as the issues they have experienced as a result of this expansion.

III RESEARCH METHODOLOGY

3.1 Development - Mount Headed Display Virtual Reality SysteM

The five primary topics discussed in this section are the choice of VR gear, user interface layout, VR navigation, tools for manipulating geometry, including those for working with WIM models, and assessment features. The application created for this research's design and evaluation phases of fast prototyping using a VR MHD will be covered in the subsections that follow. Figure 1 describes the working conceptual structure of the model workflow.

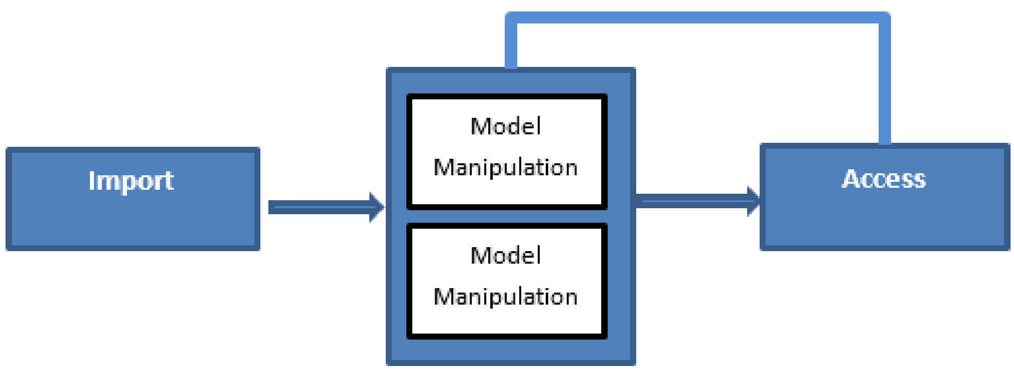

Fig 3: The VR quick prototyping process' model framework

Creation of a Virtual Reality–based Three-Dimensional Simulation System

Tourism Simulation System Based on VR Technology:

Using the created virtual setting as a starting point, the first two parts analyse and explore VR technology and VR systems in order to set up a virtual tourist system based on VR technology.

System Structure

The hardware components of a vr virtual tourism system comprise a computer, monitor, VR helmet, handles, etc., while the software components include a VR design programme, a behaviour control programme, and a few other ancillary applications. The physical components of a virtual system serve as a platform on which software may be installed and operated. The system's reliability is ensured by the organic integration of software and hardware.

- VR helmet: Multiple sensors (accelerometer, gyroscope, etc.) included into the helmet allow for precise head rotation and positioning to be realised. Additionally, a 3D virtual reality scene and stereo display screen are required for optimal usage;

- Operating handle: The handle plays a crucial role in facilitating user interaction with virtual environments. The ability to manipulate virtual objects with the handle adds a new dimension to the user experience. Simultaneously, the presence of the operational handle replaces several controls, giving the experience a fresh vibe;

3.2 ALGORITHM FOR ANN BASED VIRTUAL REALITY

Step-1: start the process

Step-2: Assign the VR tourism simulation sample

$S(x) = 1/1 + e^{-x}$

$= e^{x}/1 + e^{x}$

Step-3: Estimate the tourism VR simulation

$I^{(1)} = S\ (U^{(1)}Z+b)$

Step-4: Find the VR of tourism

$U^{(1)} = S\ (I^{(1)}Z^{T} + b)$

Step-5: Filter the conditions

$F(u, i) = -\varepsilon i\_visualb_i u_i - \varepsilon j\_hiddena_j v_j - \varepsilon_{ij} u_i v_j z_{ij}$

Step-6: ANN based VR processing like

$CD_k(Z, u^{(0)}) = -\varepsilon\ _iP(I/u_k)(\delta F(u_k, i)/\delta Z)$

Step-7: End the process

The Function of the Setting

More immersive features, like as contextual information, video introductions, and so on, should be included into the design of vr virtual systems.

- Contextualization: while adventuring in the VR system, Experiencers may learn more about the tourism and traditions of the places they visit, laying the groundwork for virtual tourism.
- To help Experiencers get into the vacation mindset and get a sense of the local customs and traditions before visiting the virtual picturesque sites, you may view several short movies with local characteristics;
- Path roaming: when tourists aren't acquainted with the area, this feature might suggest the best tour route for them, maximising their time and maximising the impact of the sights they see.

3.3 BLOCK DIAGRAM:

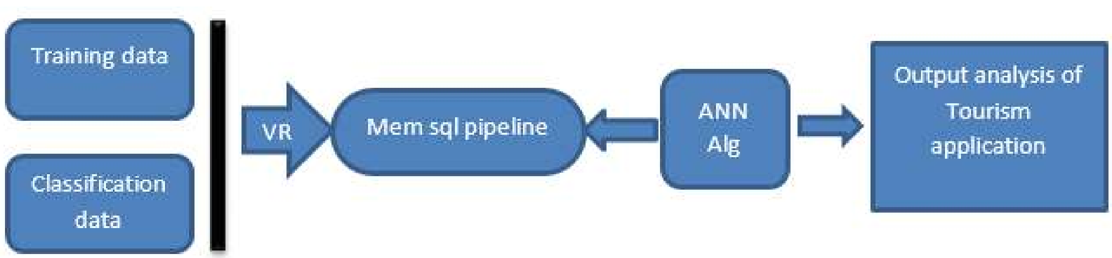

Fig 4: Implementation model

IV IMPLEMENTATION

4.1 VIRTUAL TOURISM SYSTEM IMPLEMENTATION

The virtual tourism system's design object in the experiment is a park. A slice of the 3D virtual tourism environment is carved out by the gathering of Park photographs, photos, and other data, integrated with 3D modelling technology.

Locator

The locator plays a vital role in VR-based virtual tourism systems. The locator's primary function is to track the location of the user inside the VR setup while also sending along a few data signals. The locator is usually powered by a laser locating system. Position is detected via the device's internal laser sensor, which allows full-body motion tracking detection, pinpointing the user's exact location inside the virtual environment.

- **Background Explanation:** It may pave the path for future real-world tourism by helping Experiencers learn more about the culture of picturesque sites as they explore them in the virtual tourism system;
- **Video and Picture Introduction:** Experiencers may enter the sightseeing state and get a sense of the local customs and traditions by watching short movies with local features before visiting the virtual picturesque sites;
- **Path Roaming:** If tourists aren't acquainted with the area, path wandering may suggest the best route for them to take, maximising the impact of the sights while keeping them on schedule.

4.2 EVALUATION METHOD

The building of a simple part was done in order to undertake a preliminary analysis on the efficacy of the display method, part manipulation tools, and interaction strategies used in this work. A simple double bearing assembly in the ASDS and Solidworks, a well-known CAD application, in a previous research to investigate tradeoffs in each environment [1]. Noon made note of the main distinctions between the ASDS and CAD procedures utilised to design the part during the comparison. As opposed to the CAD procedure, which required users to draw sketches, execute extrusions, and make extruded cuts, the ASDS made it possible to import, perform basic manipulation on, and rearrange primitives[10]. The test component was created with the intention of identifying any benefits or drawbacks of the conceptual design environment used in this work as it was presented in a generic MHD. The proof of concept system in this work is not intended to replace CAD, despite the fact that tradeoffs of each system were highlighted. The comparison was made merely to highlight potential topics for further research as well as benefits an example of a generic VR system's conceptual design environment. The proof-of-concept VR environment's primary goal is to increase productivity during conceptual design.

Table 1: MHD Concept comparison with latest ASDS

Parameter	Advanced-Systems-Design-Suite-(ASDS)	Environment for model Design MHD
Aesthetic Immersion	✓	✓
Immersive Extensive	X	✓
The right toolbox	✓	✓
Ability to Import	✓	✓
Geometry Components	X	✓
Deformation Form	X	✓
Multiselection Component	✓	✓

Comparing this effort qualitatively to the test component made by the ASDS was successful overall. The trial demonstrated the system's advantages and possible areas for development as well as a number of minor shortcomings. The ability to change geometry while simultaneously seeing it enabled a fully tracked immersive environment that permitted the use of traditional MHDs. The presentation highlighted the need for future development while showcasing the software's potential as a tool for conceptualising VR experiences.

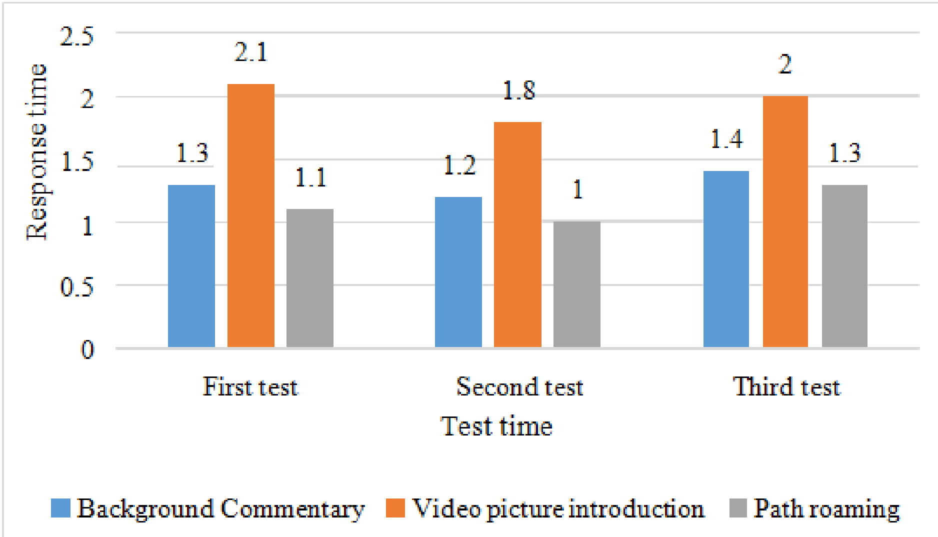

Fig 3: Response Time Test

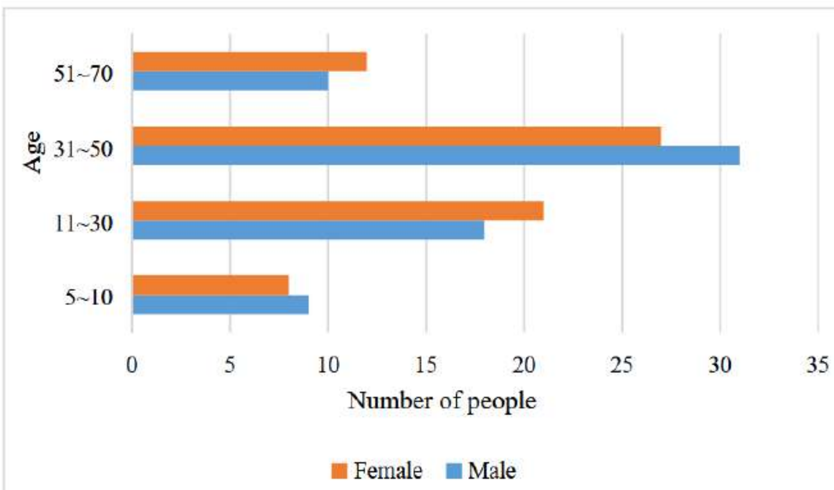

Fig 4: Gender and age wise result

Table 1: Results of Questions

Serial number	Total score	Mean value	Sort	Ease of use type	Total score	mean value	Sort
1	8	0.93	3	Fluency	22	0.73	1
2	14	0.40	5				
3	6	0.47	1	Sensory experience	80	1.33	4
4	7	1.73	2				
5	26	2.73	4	Habits of Yi ology	26	0.87	3
6	41	0.73	6				
7	11	0.73	7	Error rate	22	0.73	2
8	15	1.00	8				

V CONCLUSION

Secondary and tertiary data of varying types and sizes are produced as a result of the numerous users' actions in the Virtual World. Information like this is assigned a distinctive identifier and may be tracked in the Virtual

World powered by artificial intelligence. Artificial intelligence in the virtual world may benefit greatly from this kind of data. Applying these cutting-edge technologies will be speeded up, and you'll be able to securely and freely participate in social and economic activities that are impossible in the actual world thanks to Virtual World's usage of AI and CI technology to build this virtual reality. MHD gets around the problems with expensive, bulky VR devices. The HTC Vive, the MHD of choice, also enables the of collaborative applications using several headsets, enabling collaborative design and design evaluation. It is anticipated that AI and blockchain technology will play crucial roles in the rapidly developing Virtual World.

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