

METaverse

from avatar to digital twin

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ABSTRACT:

An avatar is a stylized user controlled persona used for social interaction in the metaverse . in contrast a digital twin is an exact data-driven virtual replica of a physical entity (such as a human , machine or city) that updates in real-time using IoT sensor and AI to mirror real-world performance . the transition from a simple avatar to highly accurate digital twin bridge the gap between basic gaming and industries / hospital computing. The avatar express a user chosen identity , which can be entirely fictional (eg an animal and cartoon) digital twin required objects measurable reality – photo grammetry , bio – metric tracking and exact physical measurement . a avatar are controlled by input (like a controller or key board) digital twin are tethered to physical counter part via live data allowing virtual diagnosis to impact real world outcomes . avatar designed for social communication role playing and self – expression digital twin are built for simulation monitoring and predictive analysis . the avatar in to digital twin platform integrated technique using natural language processing and computer vision to map human behavior , expression and physical moment in real-time enabling immersive multi sensory experience in which physical and digital environment continuously interact for a deeper dive into how augmented reality (AR) , AI and digital twin are actively shaping virtual environment you can explore the review and metaverse and digital twin.

KEY WORDS: AI,AR,VR,XR

INTRODUCTION:

Transmitting from metaverse avatar to digital twin in values moving from fictional after identified persona to precise data-driven replica of real-world entity while avatar are primarily for user expression in virtual world . digital twin replicate exact physics ,dimension and real time behavior a metaverse act as your digital-in it typically a 3D character that represent you in virtual reality (VR) augmented reality (AR) or digital gaming spaces .the social interaction , gaming self- expression and communication he digital twin simulation as expression . the digital twin is highly accurate model of physics objects person or system . it focus data analysis predictive maintenance operational playing and heavy duty simulation . it is functionally identical to the physical counterpart . it update in real-time by ingestion data from IoT (internet of things) sensor analysis and AI Built – using exact physical blue-print 3D laser scanning and massive engineering software suit as the identical metaverse expands the line between two are blurring. A basic avatar is evolving into a “ DIGITAL HUMAN TWIN” in this new paradigm . your digital persona wont just look like you . but will preceding mimic your exact body measurement cloths fits and physical movement in real-world.

METADATA MEANS:

The metadata simply means “ data about other data” it is structured information that describe , explain and provide context for a specific piece of data making it much easier to organize search and manage .

The **data** : means the actual text and stories written on the pages

The metadata means: the title , author publication date ISBN number and genre . in photo and media : record the date, time, location and camera setting(like aperture and Iso) used to take picture the title and “metadata description “written in to the code of web page . which tell search engine what the page is about in SQL information about define database table such as column names, datatypes (text VS integer) are user access control without metadata finding specific information would be like working into a massive library with

million of unsorted , un-titled books ,eta act as a navigating tools , allowing computer – searching engine and artificial intelligence to efficiency categorized index and reserve information .

The metadata is the contact , ,metadata is the documentation that explained what that (data) contact represents

Examples:

Suppose a image fie named photo .jpg the metadata this image might be –

-file size : 3MB

- resolution :1920* 1080

- date created : 25-oct-2025

Camera model: canon ESO 80D

Here metadata tells you details about the file not the content of the image itself.

METAVVERSE MEANS:

The metaverse is collective , immersive virtual 3D space where user interact with each other computer generated environment using digital avatar often called the “ next generation of the internet “ it combine virtual reality (VR) augmented reality (AR) and digital environment to let people socialize work and play..

The immersive instead of looking at a screen you step in to digital world using “ virtual reality” headset or AR glasses . the virtual spaces remaining active and challenges even after you log off . you can built home often even or work with others just like in the physical world the ultimate vision is assets network where you can carry your digital identity , inventory and currency across different platforms and virtual world. While fully connected , universal metaverse is still evolving various element exit today . gaming world massive online platform like ROBOX or FONTNITE serve as early metaverse space . where player gather for concert socialize and create their own games the social VR apps like horizon world (BY META) allow used to meet , play and collaborate in 3D digital spaces using meta store hardware’s .virtual work space comprise use VR to built digital offices and collaborate work spaces where remote team can interact as if they act in the same room. The word “METAVVERSE” combination of “META” (beyond) and “universe” used to describe an all encompassing virtual world running parallel to physical reality.

The metaverse work through immersive 3D virtual environment that use access via VR headset augmented reality (AR) device or traditional screen . these technology create a serve of presence and spatial awareness that goes for beyond typical work browsing or video calls.

-with VR user can look around , gesture manipulate object and move through as if they were physically present.

-with AR , the technology overlay digital element on to the real-world , blending virtual and physical experience

The “inter connected” aspect means these virtual space can theoretically link together , allowing user to move seamlessly between different world and platforms while maintaining their digital identity and possession

SOME POPULER METAVVERSE:

- Meta (FACEBOOK) . meta currently working to built a VR social platforms accessible through its headset , the meta QUEST 2 with the headset meta offer uses unique social experience and the opportunity to connect meta others.

- MICROSOFT: views on the metaverse revolves around work as same by its team collaboration platforms which is word by business and organization word wide the company aims to advance it is metaverse by including artificial intelligence gain insight based on the data its collect

- EPIC GAME : is one of the most popular metaverse example because is popular game , Fortnite which has become iconic for the “emotes” that is avatar do Fortnite has also hosted virtual concert for its uses , including performance by TRAVIS Scott and Aviana grant.
- ROBOX: is working to provide user – guaranteed .video games through the metaverse and create virtual environments and digital assets for it uses.
- MINE CRAFT: game mine craft is fully open ended and customizable , you can create your own metaverse with in the game on your owns servers , mine craft additionally connect to the metaverse as a VR – compatible game . as the technology behind the metaverse and improves and become more powerful the different way to use it will expands , through the metaverse is technology still in its experimental stage you can various things real thing to gaming , social interaction and works.

METAVVERSE TEAM: if you are interacted in entering the metaverse being frequently used team may be helpful to your experience take a look at these common team

_ AVATAR

- VIRTUAL EXAMIN
- MIXED REALITY
- AUGMENTED REALITY

AVATAR:

If you have been on the internet for some time , you must already be signed up for multiple social media accounts pending on the platforms user either uploaded their photos for here profile or create a 2D or 3D model of themselves for it that is where are conversion begins put simply an avatar is an online representation of user . this digital identity different from person and can either be static or animated. The big different here will be flexibility to while some avatar restricted to only single platform , a metaverse avatar will be to cross through different expression in the entire metaverse, so what ever avatar you create along with their appearance will early carry over to different virtual world you will visit the avatar their became your identity in metaverse .

AVATER IN METAVVERSE: in your digital identity or graphical representation in virtual world augmented realty and virtual space . it allows to socialize work and play serving as you personal online presence at move with your across different digital environment and platforms

TYPES:

Stylized / cartoons: highly customizable cartoonish design(like Bit emoji’s)popular for gaming and casual social hangout.

-3 D Virtual reality: immersive full – body represent that mirror you gesture making physical interaction feel more nature.

- Photo realization / code avatar : advanced hyper- realistic avatar that use sensor to mimic real-life facial expression and non- verbal cues in real-time.

VIRTUAL REALITY:

The virtual reality is the persistent shared ,3D virtual networks where user interacts work and socialize , while virtual reality (VR) is the immersive technology used experience it think of metaverse as the destructed and VR a one of the primary most immersive vehicle used to get thermometers isa experience , inter connected digital universe VR as specific technology that simulate a 3D environment . the metaverse exists continuously , even when you are not logged in VR experience usually pause when you remove the headset . the metaverse aim to decentralized ownership (using BLOCK chain , NFTs) allowing users to owned by the platforms provide . metaverse is a social economic system VR is a hardware based immersive experience . while you can access the metaverse via desktop or mobile VR provide the most immersive “embodied” experience of it use wear VR headset to explore 3D world play game and attend virtual events within high sense of presences.

AUGMENTED REALITY:

(AR) is the technology that overlay digital objects, information and characteristics on to the physical world serving as a visual bridge between real and virtual environment in the metaverse AR allows¹ user to experience immersive digital space while remaining presence in their actual surrounding.

SPACIAL COMPUTING:

AR transform the physical world in to canvas enabling digital environment to instruct naturally with real surface and walls.

MIXED REALITY:

MR advanced AR blends physical and digital world allowing you to manipulate both real and virtual object seamlessly.

AVATAR and DIGITAL TWIN:

user can project digital avatar in to their living room or instruct with hyper account 3D replicas of physical location.

HARDWARE and SOFTWARE:

Companies like meta plus AR capability through their desk and app while google support spatial computing and AI- powered glass via platforms like google AR and VR.

SPATIAL WEB:

Instead of viewing the internet as flat 2D screen AR enable persistent, interactive experience that can be accessed globally or anchored to specific real-world location.

REAL-WORLD APPLICATION:

GAMING : AR bridge the gap between reality and the metaverse through the location based mechanism and real time instruction, popularized games like Pokémon go.

REMOTE COLLABORATION:

Professional users AR to share 3D model and internet with collaborative avatar, overlaying technical schematics directly on to physical work spaces.

RETAIL and E-COMMERCE:

Shopper can virtualized how function fits in these room or view digital only wearable overlaid on to them actual reflection.

MIXED REALITY:

MR in the metaverse seamlessly merge physical and digital environments allowing user to interact with both real-world surrounding and virtual objects simultaneously rather than fully replacing physical world. It bridge the gap enabling life-like, context awareness instruction anchored directly in the local space. MR provide tangible, practical layer to the metaverse through several key functionality

SPATIAL ANCHORING : digital asset (like shared 3D white board or a virtual piano) are located to physical surface in your room. High resolution cameras on modern headset stream a color view of your physical environment – enabling safe movements which interact with the digital counterpart.

SHARED PHYSICAL and DIGITAL SPACES: multiple user can inhabit the same digital platforms which retaining physical awareness of their immediate surrounding, opening up new method for collaborative work and socializing.

EXTENDED REALITY:

XR is the technology of the metaverse it encompass virtual reality(VR) , augmented reality(AR) and mixed reality to connect the hardware and software gateway that allow used to interact with persistent digital environments.

ROLE of XR :

XR act as a engine that bridge to metaverse to life rather than merely browsing the interact user “live” inside it via specialized headset so small glass . MR allows physical object (like your physical desk)and digital assets (like virtual mirror)to co-exists and interact in real-time.

DIGITAL TWIN TECHNOLOGY in METAVERSE:

It in values integrating immersive shared virtual environment with highly accurate real0time data-driven replicas objects , system or process, while the metaverse provide the interactive virtual space, digital twin supply the precise functional function that bridge physical assets with digital reality.

THE MERGE TECHNOLOGY:

Visualize the metaverse enable user via avatar to explore and interact with highly granular persistent 3Dmodel of real-world functional building or cities.

REAL -TIME data STREAM:

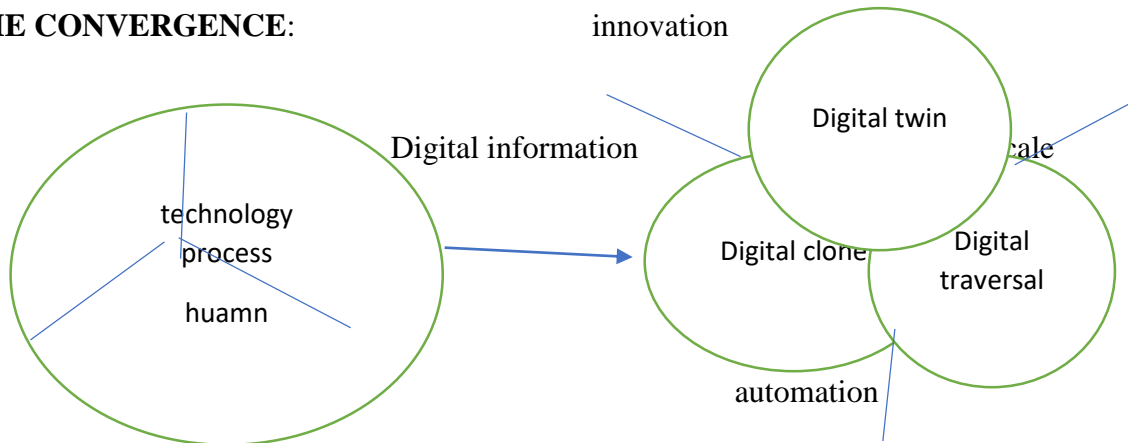
Digital twin ingest like IoT (internet of things) sensor data AI analysis and machine learning model to replication the exact current status of their physical counterpart.

ACTIONABLE

user in their metaverse are not just looking at a static virtual building they can view real-time energy consumption simulate-stress -test or practice evaluation on the exact pre place of the physical work place .

SIMULATION:

THE CONVERGENCE:



In the broad architecture landscape of the metaverse both concept are merging .avatar act as a operate interfaces allowing a human to experience a virtual space which digital twin serve as the foundational environments bringing from – to – life physical and analysis to thread space.

CONCLUSION:

The transition from basic metaverse avatar to a digital twin represents an evaluation from fictional , structure representation to data-driven , real- time reflection this shift events virtual identity from a cartoons gaming mask into high accurate measurable and instructive digital replicas of a physical entity or person. Understanding this transition energy light exact how our relation ship with virtual world is evolving . primary four personal experience role-playing and social immersion in virtual spaces often static cartoon or merely customized dictate primary for walls input (eg liking to make a character wave) disconnected . the avatar does not inherently update based an a user real-life physical state or physical – world data . the digital twin

creation of an automatically and balancing accurate digital counterpart of a specific real-world human. Hyper – redesign or visually in granularly from the real person power by real-time data , IoT sensor and AI if the physical person moves their moves in the lock step . bi-directional the twin reflect the physical person exact state (heart rate , tress level, fatigue) and can simulate virtual scenarios to predict real-world health or economic outcomes.. the conclusion of the shift to the metaverse causes to be just a “ game place” and instead became a vast inter connection networks of digital twin .because digital twin use immersive connect of the intimate personal and operational data, the four shift to data primary and digital self- sovereignty individual (physical entity) connect own and control the AI model governing their digital representation .moving from avatar to digital twin provide immersive red-world values . it allows to collaborate thar complex scenario and optimize physical process entirely with in digital realm – weather that is a doctor performing a virtual surgery or an engineering testing a factory layout.

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