for digital art. These unique avatars are a way to give your digital identity visual representation in 3D worlds: they are your identity in the metaverse.

Decentralized Technology

Every single piece in the metaverse embraces the core concept, shown in Fig. 5.

- **Decentralized Computation:** Decentralized computation- in a metaverse virtual reality, everything is data and everything happening is computing. Decentered computation gathers all the powers together to provide all the calculations people need to build their perfect world. The computation will be efficient and accurate.
- **Decentralized Storage:** Inside the metaverse, we have land, space, energy, power, buildings, medical healthcare materials, and many more. Everything is safe here for the reason of metaverse data storage is fully decentralized, it is owned by everyone, it is managed by everyone, and everyone together will ensure its existence like the metaverse will build upon it. Also, we will have full features on the data: everyone will be confident that the data won't be modified by others because of storage decentralization.
- **Decentralized Database:** It will provide a solid base for metaverse citizens to organize their data so they can use them to build anything that they can imagine enriching the universe. And at the same time, they will have full confidence that the data is always there for us.
- **Blockchain:** To ensure the decentralized nature of the metaverse, blockchain is the core of all the infrastructure. Blockchain will ensure the decentralized data, decentralized database and decentralized computation is fully trustful and ensure only the citizens of the metaverse have ownership of everything in the virtual space.

Social Computing

Metaverse social computing included avatar description, avatar identification, avatar interaction, and avatar organizational work.

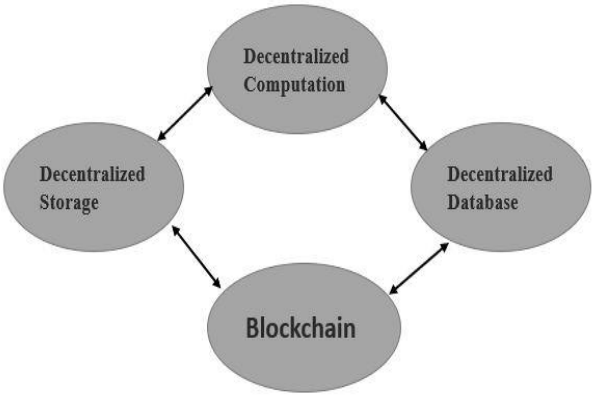

Fig. 5. Metaverse decentralized technology

D. Virtual Reality Space Convergence

Metaverse Extended Reality

Since the data and avatars of users of the Metaverse platform are located on different servers around the world, Metaverse handles different personal data processing in each country using AI techniques. Fig. 6 shows the extended reality in Metaverse [32].

- **Virtual Reality:** It is a technology that substitutes one's vision of the physical world with a digitally produced scene using software and headgear devices. While wearing full-coverage headsets, you are entirely cut off from your surroundings and the actual world. A computer-generated virtual environment is reflected by the LCD screens inside the lenses of these headset devices, and your viewpoint is replaced.

- **Augmented Reality:** It is a technology that blends the digital and real worlds. It uses computer vision to recognize real-world surfaces and objects using technologies such as object recognition, plane detection, facial recognition, and movement tracking, among others. The computer then overlays computer-generated data like graphics, sounds, images, and messages on these previously recognized planes.

- **Mixed Reality:** It is a hybrid of augmented reality and virtual reality. It's also known as Hybrid Reality since it incorporates both real-world and digital aspects. While MR is primarily a technology for combining the physical and virtual worlds, the most appealing technology is the lifelike interaction between users and digital items. These three technologies are also used in the healthcare domain.

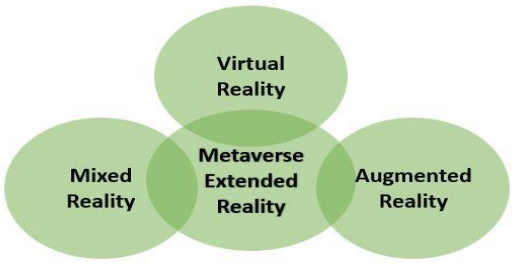

Fig. 6. Metaverse extended reality

Brain-Computer Interface

Since the data and avatars of users of the Metaverse platform are located on different servers around the world, Metaverse handles different personal data processing in each country using AI techniques [33].

- **Acquisition:** These signals are acquired from the brain and then amplified and tuned, and noise is removed to convert the input signal into a format that can be digitized and sent to a system that can be further interpreted.
- **Feature Extraction:** This step involves extracting certain characteristics and footprints that indicate the presence or absence of a particular intent. These characteristics can be time-triggered EEG or ECoG response amplitudes and latencies, power within specific EEG or ECoG frequency bands, or firing rates of individual cortical neurons, etc.
- **Feature Interpretation:** In this step, the characteristics obtained in the previous steps are analyzed, and a conclusion is made as to what may be the intent of the user. Since the human brain is extremely fast and complex, these translation algorithms must be dynamic and adaptive to new signals and features in real time.

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