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EXTENDED REALITY (XR)

-THE FUTURE OF IMMERSIVE TECHNOLOGY

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ABSTRACT

The word used to signify any real-and-virtual mixed environments and interactions between humans and machines produced by computer technology and wearables is Extended Reality (XR). The 'X' symbolises an indicator for any current or forthcoming computing technologies. It includes locations that have been added to perceptual representations like augmented reality (AR), mixed reality (MR), and virtual reality (VR), for example. There are various levels of virtual reality, ranging from partially sensory inputs to immersive virtual reality, sometimes referred to as VR. The phrase "the full realistic" to "the full artificial" is used to describe XR in the context of the reality-virtuality continuum. We provide two approaches that utilise the VR-IoT solution: a local network-based approach, as well as a cloud-based one. In order to standardise usage and broaden the term's meaning to embrace all coexisting "realities," the term "Extended Reality" attempts to encompass all terminologies previously used. The latest version of the Infrastructure supporting VR-IoT synchronisation scheme VRITESS, which enables
users to control realistic IoT objects with VR headsets, has been included in the proposed VR-IoT environment. This scheme helps users have a consistent and integrated experience. In a virtual environment, it may be easier to control some IoT gadgets that must work in harsh conditions or complicated technologies. The advancement in technology has the power to fundamentally transform how we go about living our daily lives since it will alter the way we see the world.

Index Terms : Virtual reality (VR), augmented reality (AR), mixed reality (MR), and VRITESS are all forms of virtual reality.

INTRODUCTION

"Extended reality" (XR) is the term used to describe any real-and-virtual hybrid settings and human-machine interactions created by technology such as computers and wearables. For any existing or impending computing technologies, the letter "X" serves as a signal. It includes locations that have been combined into perceptual representations, such as in augmented reality (AR), mixed reality (MR), and virtual reality (VR), for instance. Virtual reality, or VR as it is usually abbreviated, can take place at many stages, ranging from partially sensory inputs to immersive virtual reality. The idea of a continuum between reality and virtuality states that XR is a mixture that lies halfway between "the full realistic" and "the full artificial."We provide two approaches that utilise the VR-IoT solution: a locally network-based approach and a cloud-based approach.This concept is constantly evolving as human-computer interaction technology develops. Applications for XR range from leisure to advertising to real estate to training to remote work. It is a

rapidly growing sector.

In accordance with one definition, Extended Reality (XR) is "an umbrella term enclosing AR, VR, andMR.

Virtual Reality: In a digital context, VR makes a variety of intellectual interactions possible. As a result, users are immersed in fictional universes. The gaming and media industries are increasingly embracing virtual reality because it makes it simple to turn the abstract into "reality." Players of virtual reality games frequently use programmes such Beats Sabre and Career Simulation. Several sectors are starting to adopt this technology on a regular basis.

Although Gear VR and Daydream smartphones can offer a more basic Virtual Environment (VE) by utilising Smartphone sensors (gyroscope, geo-localization, and others), Oculus Rift and HTC Vive appear to be the most potent VR headsets (PC required).A completely new group of players was introduced to virtual reality with PlayStation VR. Oculus Go, a recently released standalone VR device, seamlessly combines smartphone and PC headgear.

Augmented reality: Virtual reality, on the other hand, is not augmented reality (AR), and the reverse is also true.The implementation of augmented reality enables viewers to interact with artificial items positioned within the real environment.

Motion tracking, light estimation, and environment comprehension are the foundations of augmented reality. Using this, environments are constructed and 3D items are placed in actual space. They can be used to experience augmented reality (AR), as mobile devices Many electronic devices, like tablets and smartphones, include a number of sensors, including a camera, a speedometer, a tilt sensor, an electronic compass, and others.

Mixed Reality: In order to describe the sensations that obfuscate the distinctions between VR and AR gadgets"Mixed Reality" is a word that was created. In order to create new settings and visualisations where digital and physical elements can coexist (actual elements added to VE, virtual objects added to the physical universe, as well as perhaps virtual objects added to virtual world), MR combines AR and VR technology.By letting people visualise the models at precise scales, MR can be used as a tool for 3D modification (like CAD models).

We created an innovative social VR-IoT environment for this that enables users to share and control adjacent or remote IoT devices via a virtual platform. We offer two approaches that leverage the VR-IoT solution: an actual network-based approach, as well as a cloud-based one. The idea for a VR-IoT ecosystem includes the novel VRITESS synchronisation method for the VR-IoT environment, that allows users to control genuine IoT devices using VR headsets. Users benefit from a unified and consistent experience thanks to this plan. Some IoT devices that need to function in challenging environments or with complicated technology may be easier to control in a virtual environment.

Digital manufacturing has received a lot of attention over the past ten years as a very promising set of technologies that can reduce product development costs and delays while simultaneously addressing client customization, element of production, including design, prototyping, learning, marketing, logistics, maintenance, set-ups, remote guiding, assembly, etc. Technology like XR (augmented, mixed, and virtual reality) may help build this bridge as well as boost time- room flexibility, or the requirement that team members not be in the same place at the same time when working on a project. These developments are also necessary to give business the tools it needs to make decisions more quickly and effectively.

IoT devices and XR devices' data communication model.

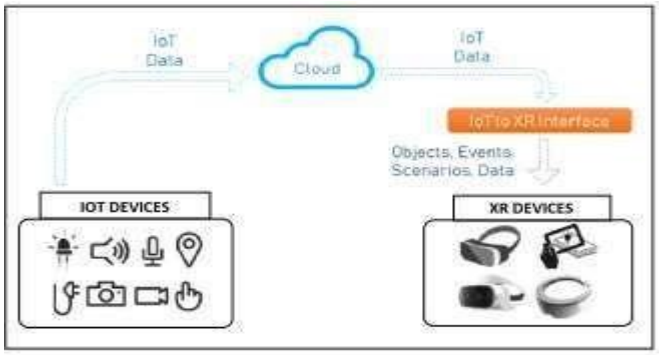

Fig. 1 illustrates a data transfer model for IoT and XR devices.

To build XR systems for IoT circumstances, especially when real-time applications are taken into consideration, IoT data must be exchanged swiftly and safely between IoT devices and XR applications. We suggest a method for transferring data between IoT and XR devices. The IoT devices (which produce data), a Cloud service (public or private), a software module that connects the data from the IoT and the XR apps, and the XR devices (which run applications) make up the four primary parts of this data model. The IoT to XR interface is a part of an application that takes in IoT data and analyses it by gathering and filtering significant values (such device type, location, and IP address), understanding context, and performing appropriate computations.**Virtual and physical world devices**

Innovations like smart automobiles, wearables for monitoring one's health, and smart home devices are changing how people engage with electronic gadgets. Nevertheless, some IoT gadgets are still complicated to use and fail to deliver a mature and simple user experience. Thanks to multimedia solutions like this, users can take advantage of rich media experiences. When c0mbined with Virtual Reality (VR) techn0logy, authentic scenarios with aural, tangible, and visual aspects can improve the perception of reality by transforming the physical world into a realistic virtual environment. Based to, communicating with and understanding IoT devices can be facilitated by leveraging gestures, language, and other human senses. IoT devices that can be tricky to use or that are in dangerous environments, such landslip sensors or water level monitoring equipment, are able to function more readily in a virtual environment. Users will be able to access applications and gadgets as well as exchange material thanks to the social IoT, which is made possible by the virtual environment.

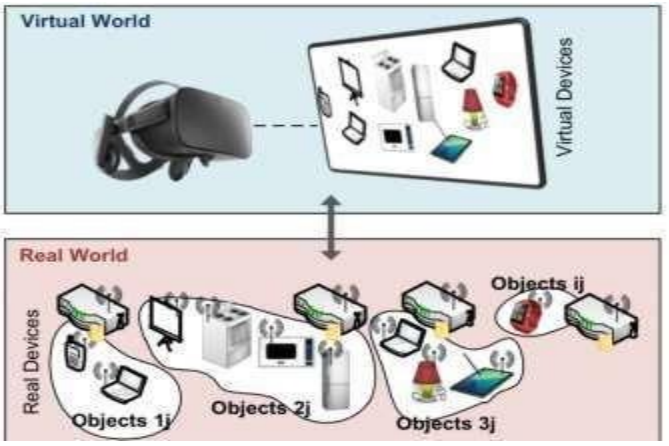

Fig 2. Real world and Virtual World [4]

The visualisation employs a user-friendly interface in a virtual reality environment that enables interaction with actual items. Users' actions when manipulating a device in a virtual environment affect both real-world things and the virtual world as well. Because VRITESS manages the synchronisation between them, changes made to real things will likewise be reflected in virtual ones.

Need for Extended Reality:

- Proximity is a tactical issue that both customers and companies face. The major technological difficulties of today are real-time visualisation, interaction with large amounts of data, and

sharing information and working together. We think XR and IoT could be helpful in this situation since they lower the barrier of distance while opening up new knowledge and experiences.

- Since education is becoming more important in society, we predict the creation of more applications combining XR and IoT in this field. This is primarily because these innovations provide a means of demonstrating or simulating operational structures without the a simulated environment where users can gain knowledge and practical experience without having any impact on an already implemented solution.
- We agree that the combination of VR and IoT can provide a useful channel for reaching out to investors and stakeholders for product sales and marketing. not only to display infrastructures but also to facilitate conceptual visualisation and understanding.

Challenges of Extended Reality:

- The most significant issue with virtual reality is motion sickness (MS), which is defined as general discomfort, apathy, drowsiness, headache, disorientation, or tiredness users may experience during or after a VR session. Following certain guidelines is essential to keeping the immersion effect intact and avoiding MS: depth-perceiving the surrounding environment as a whole.Since extensive usage of sensors quickly depletes a device's battery, power consumption is AR's biggest problem.
- The only devices n0w on the market are members of the "Windows Mixed Reality" family of gadgets [28], led by Microsoft HoloLens. For their next-generation gadgets, businesses like Oculus and HTC are also researching MR.

METHODOLOGY

The VRITESS Architecture

On top of an IoT architecture, VRITESS is put into action. The fundamental IoT architecture was introduced, put to use, and expanded upon in. The architecture that deploys VRITESS consists mostly of the following elements: Smart appliances, wearables, health monitors, and sensors are a few examples of Internet of Things (IoT) objects that offer services to users and other devices. Each of these IoT items has both a real (the actual IoT device) and virtual (the VR depiction of the actual object) instance.

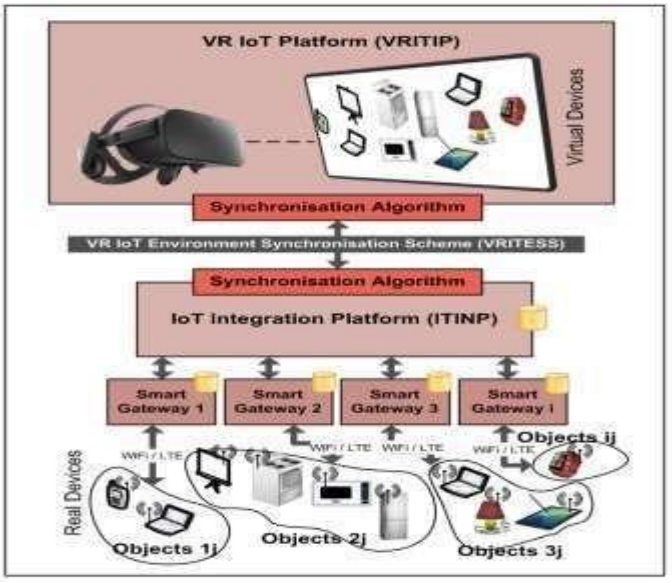

Fig 3. VRITESS Architecture [4]

Using IoT protocols like the MQTT protocol, VRITIP and ITINP can communicate across local networks or the cloud. According to timestamps, the local network solution updates both real and virtual devices by storing the operations performed in each type of device in a local database. The operations and timestamps are stored in a cloud-based IoT protocol-enabled database in the cloud-based method, and both ITINP and VRITIP

continuously access the data. Both ITINP and VRITIP use VRITESS to keep devices up to date with the data kept in the local or cloud-based databases. ITINP and VRITIP clocks are synchronised over networks using Network Time Protocol (NTP), preventing synchronisation errors.

PROCESS OF COMMUNICATION

Gateways are computers that keep a status structure of the actions related to the gadgets. ITINP receives practical operations, VRITIP receives virtual operations, and VRITESS enables two-way synchronised and interaction between these activities. The functionality of both virtual and real devices must be updated using the most recent data in these status structures. In order to perform tasks like turning on and off lights and appliances, reading temperatures, motions, and activities via sensors, and turning on and off motors for opening and closing doors and curtains, among other things, a range of devices can make use of this communication architecture. The status structure and update techniques it offers allow for tracking how users interact with devices in any location because users can be found in both the physical and virtual worlds.

The device status structure utilised in the local and cloud-based databases is demonstrated by the example that follows (which depicts a virtual user turning off a virtual object):

{
"timestamp": "2019-04-15T09:l5:12.147"
"last_change":"2019-04-l5T09:14:23.133"
"user_id": "anders0nsimis"
"type_of_user": "virtual"
"type_of_device": "virtual"
"tags: ["POWER_INSTRUCTION"]
"device_id": "0036:5E25:0000:2lDC"
"data" "0FF"
}

The actual device will also be turned off as a result of this action, and the proper status structure will be updated:

{
"timestamp": "2019-04-15T09:15:12.235"
"last_change":"2019-04-15T09:14:23.224"
"user_id": "andersonsimis"
"type_of_user": "virtual"
"type_of_device": "real"
"tags: ["POWER_INSTRUCTION"]
"device_id": "0036:5E25:0000:21DD"
"data" "OFF"
}

In this example, a virtual user switches off a virtual object, which causes the real item to undergo the identical operation. Turning on a device, changing the temperature on a thermostat, and other operations carried out in the virtual environment are synchronised in ITINP and updated in the database of the smart gateway in charge of connecting the corresponding real device, with the instruction being sent to the object using an IoT protocol like MQTT.

It is possible to record the actions in real and virtual devices thanks to the solution architecture's inclusion of databases at the gateway and cloud levels. Details are recorded after the status structure shown in this section when an action is done.

The installation of a local database (MySQL) in the local network-based solution and a cloud database (Adafruit IO) in the cloud-based solution are both covered in detail.

Individuals who log into the applications are limited to managing the devices that they share or own because the technology behind databases also makes it possible for individuals to be recognised while executing activities. The platform's social feature is the capability of allowing other users to operate gadgets on the virtual platform. The devices are updated using the VRITESS synchronisation algorithm in accordance with the operations carried out in the virtual and real versions of the devices, accordingly.

The VRITESS synchronised approach works at the level of ITINP (acting on the actual objects) and VRITIP (acting on the virtual objects), respectively, to both real world and virtual world devices in order to assure consistency. Using an algorithm, the synchronisation of IoT devices between the physical and virtual worlds is shown. Based on the timestamp value of the most recent action done by both real and virtual users, it sends that information to ITINP and VRITIP. ITINP and VRITIP use the Network Time Protocol (NTP), which enables online clock synchronisation.

Research Trends

Organisations are now making investments in the metaverse. The top multinational corporations conduct R&D studies for many types of software and hardware.

A Metaverse-friendly environment has arisen as a result of the development in augmented reality devices (virtual, augmented, and mixed reality), the growth in bitcoin transactions, and the general adoption of blockchain technology. The metaverse is a produced virtual or augmented reality.

beyond the confines of the physical world utilising augmented reality devices, game consoles, laptops, tablets, or mobile phones connected to the internet. This universe may be created partially by virtualizing aspects of reality or it may exist independently of reality. Metaverse may be used as a tool for creating urban policy, despite its potential to be easily employed in all aspects of daily life.The study will cover the conceptual underpinnings of the metaverse, investments made by multinational corporations in the metaverse, the concept of the metaverse in relation to virtual reality, the implications of the applications of the metaverse for cities, and finally the effects and role of the metaverse in the development of urban policy.The most popular technologies that effectively exploit

the Metaverse today are virtual, augmented, augmented, and mixed reality applications.

Numerous technical advancements in the entertainment, medical, educational, and automotive industries are connected to these reality practises [11]. While XR was previously only used "in the laboratory" or in private settings, it is now more widely accepted in society, including in emergency preparedness and evacuation planning, civil defence, aviation, almost all academic fields, and the private sector [12]. In terms of wealth, socialising, productivity, business, and ecreation, the realm of metaphysics holds the potential to enable a greater crossover between virtual and real lives—whether on devices for virtual and augmented reality or on a display or console [6].

CONCLUSION

The ground-breaking VR-IoT Environment Synchronisation Scheme (VRITESS) is introduced and described in brief. Users of the proposed VR-IoT platform can interact with IoT devices virtually. It also features a synchronisation algorithm that updates both virtual and real IoT objects in accordance with actions and events that occur in both the virtual and real worlds, reflecting changes on one another. Using XR technology in IoT contexts led to various exciting ideas in several sectors, even though the majority are proof-of-concepts or in the early phases of development. We have created a universal data communication paradigm to allow XR apps that seek to leverage IoT data.The VRITESS real-world testing used both a local network-based solution and a cloud-based deployment with a 3D room made with Unity. The results of the tests show that the cloud-based approach has more delay than the local-based approach. RESTful API and MQTT were the two communication protocols employed in thecloud-based scenario. According to the test results, MQTT performed better because of its lightweight architecture, which resulted in a lesser delay and less data being sent.architecture.

REFERENCES

[1] IoT Smart Cities, Microsoft. Available: https://www.microsoft.com/ en-us/internet-ofthings/ smart-city, accessed in January 2019.

[2] The Void VR Experience Startup Is Worth Paying Attention To, Yahoo Finance. Available: https://finance.yahoo.com/news/ void-vr-experience-startup-worth-020600309.html.

[3] Z. Zhang, M. Zhang, Y. Chang, E.-S. Aziz, S. K. Esche, and C. Chassapis, ―Collaborative Virtual Laboratory Environments with Hardware in the Loop,‖ in Cyber-Physical Laboratories in Engineering and Science Education. Cham: Springer International Publishing, 2018, pp. 363–402.

[4] Simiscuka, A. A., Markande, T. M., & Muntean, G. M. (2019). Real-Virtual World Device Synchronization in a Cloud-Enabled Social Virtual Reality IoT Network. IEEE Access, 7, 106588–106599. https://doi.org/10.1109/access.2019.2933014

[5] "Alienware Aurora", 2018. [Online]. Available: https://www.dell.com/en-ie/shop/desktopsand- all-in-ones/alienwareaurora/ spd/alienware-aurora-r7-desktop.

[6] Clark PA. The Metaverse has already arrived. Here's what that actually means. Time Mag. 2021 Nov 15;

[7] From Reality to Virtuality: Re-discussing Cities with the Concept of the Metaverse. (2022, February 21). International Journal of Management and Accounting, 12–20. https://doi.org/10.34104/ijma.022.00120020

[8] Andrade, T., & Bastos, D. (2019, June). Extended Reality in IoT scenarios: Concepts, Applications and Future Trends. 2019 5th Experiment International Conference (Exp.at'19). https://doi.org/10.1109/expat.2019.8876559

[9] Windows Mixed Reality - Wikipedia. (2015, January 21). Windows Mixed Reality - Wikipedia. https://en.wikipedia.org/wiki/Windows_Mixed_Reality

[10]Simiscuka, A. A., Markande, T. M., & Muntean, G. M. (2019). Real-Virtual World Device Synchronization in a Cloud-Enabled Social Virtual Reality IoT Network. IEEE Access, 7, 106588–106599. https://doi.org/10.1109/access.2019.2933014

[11]From Reality to Virtuality: Re-discussing Cities with the Concept of the Metaverse. (2022, February 21). International Journal of Management and Accounting, 12–20. https://doi.org/10.34104/ijma.022.00120020

[12]Çöltekin, A., Lochhead, I., Madden, M., Christophe, S., Devaux, A., Pettit, C., Lock, O., Shukla, S., Herman, L., Stachoň, Z., Kubíček, P., Snopková, D., Bernardes, S., & Hedley, N. (2020, July 15). Extended Reality in Spatial Sciences: A Review of Research Challenges and Future Directions. ISPRS International Journal of Geo-Information, 9(7), 439. https://doi.org/10.3390/ijgi9070439