EXTENDED REALITY
(FUTURE TECHNOLOGY)

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Abstract: The advent of extended reality is revamping the way people experience the physical and the virtual environments,from observation to immersion. XR technologies such as Augmented Reality (AR) and Virtual Reality (VR) are increasing at day to day life but are still in need for validation in order to make good strategic decisions regarding implementation. The areas where most industries apply AR is within remote guidance and complex tasks such as maintenance. This paper aims to show some cases using extended technologies in different phases in the production systems and future potential of the technologies.

Keywords: Augmented Reality, Virtual Reality, Mixed, Real World, Hybrid Reality, Seamless Data, data security, military.

I. Introduction

Digital manufacturing has been considered, over the last decade, as a highly promising set of technologies for minimizing the product development times and cost as well as product quality, and faster response to the market . Bridging of digital/cyber/virtual and physical worlds can mean a lot of time savings in almost all areas. Technologies like XR (i.e. *A*ugmented, *M*ixed and *V*irtual Reality) could be useful to increase time-room flexibility i.e. the need not to be at the same place at the same time when working in a project and are needed to empower industry with a faster and more powerful decision making process . Cyber- physical systems are growing and is a big part of the industry . The market is exploding with both the technologies with apps and wearables . More and more companies are considering an increase of digitalisation in parts of company through XR.

II. Extended Reality technologies

Extended reality (XR) is a term referring to all real-and-virtual combined environments and human-machine interactions generated by computer technology and wearables. There aredifferent types of XR technologies i.e. Virtual Reality (VR), Mixed Reality (MR) and Augmented Reality.

Figure1: Relationship between the technologies

1. **Virtual reality**:VR is computer-mediated technology that allows for the manipulation of real environment in which the users can interact with and feel a sense of presence .The illusion of 'being there' is a psychological state that occurs when a user feeling lost or immersed in the virtual world which enables him/her to temporarily escape from the real world.VR is most common for product development and marketing, it could also be usedfor training,ergonomics and visualization of digital factories(design phase,could be both green field and brown-field applications).

Figure 2: Gaming through VR .

2. **Augmented reality**: In AR, virtual information and objects are overlaid on the real world. This experience enhances the real world with digital details such as images, text and animation. In this type of reality users are not isolated from the real world and can still interact and see what's going on in front of them. The most well known examples of AR are the Pokémon GO game that overlays digital creatures onto the real world or snapchat filters that put digital objects such as hats or glasses onto your head.

Figure 3: Business through AR

3. **Mixed reality**: In mixed reality, digital and real world objects co-exist and can interact with one another in real-time. This is the latest immersive technology and is sometimes referred to as hybrid reality. The first immersive mixed reality system, providing enveloping sight, sound and touch was the virtual fixtures platform developed at the U.S. Air Force's Armstrong Laboratories in the early 1990s.The combination of all three-computer processing, human input, and environmental input—sets the opportunity to create true mixed reality experiences .Movement through the physical world can translate to movement in the digital world. Boundaries in the physical world can influence application experiences, such as Game play, in the digital world.

Figure 4: Mixed Reality

III. Uses of the XR technologies

1. It gives customers the ability to try before they buy.
2. Watch manufacturer Rolex has an AR app that allows you to try on watches on your actual wrist.
3. Furniture companies gives customers the ability to place furniture items into their home via through their smartphone.
4. Training: XR can provide training tools that are hyper-realistic, that will help soldiers, healthcare professionals etc.
5. Remote- work: Workers can connect to the home office or with professionals located around the world in a way that makes both sides feel like they are in the same room.

IV. Advantages of XR technologies

1. **Provides outstanding visualizations that aren't possible in the traditional classroom.**
   Virtual reality is great because it lets us explore different realities and alternate our experiences. By wearinga VR headset, you're encountering high quality visualizations that can mark you in a positive way. The traditional teaching methods can never reach such an effective way of emphasizing things through visualizations.
2. **Efficient information uptake**
   XR provides its users with a more realistic view of their subject matter,which allows them to be trained in a more effective manner.
3. **Safe training**
   Those who need to practice in high risk conditions, such as military or chemists, can train safely from conventional classrooms
4. **Seamless data access.**
   XR removes distance barriers,which is why humans can smoothly access remote data.
5. **Helping learners stay focused.**
   XR technologies ensure employees' focus on the training process.For example,a VR headset isolates a trainee from the real world and its distractions.Thus,it increases employees' attention and facilitates faster learning

V. Disadvantages of using XR technology

1. **Artificiality**
   No matter how realistic XR training may be, it doesn't have the same consequences as training and working in the real world, where factors like psychological state may come into play.
2. **Lack of flexibility**
   Training with XR lacks the flexibility of traditional training,where employees can give suggestions and ask questions.With XR,it's impossible to adapt training in the moment,and learning is restricted by the software.
3. **High costs**

Developing, updating and supporting software and headsets for VR,AR and MR, is still expensive,as is the creation and deployment of training content in a 3D environment.

4. **Health risks**

   Immersive technologies pose certain health risks for users. Wearing headsets for long periods of time may cause stress and anxiety,nausea, and eye strain.When learners use them alone, XR devices may even cause injuries by, forexample, stumbling over real world objects.

5. **Privacy and data security**

   Capturing information about employees and recording their performance during VR training raises ethical questions.There is a fine line between gathering relevant data and total surveillance. In addition,VR providers typically can't ensure complete personal data security.

VI. Future Enhancement

From being science based concept to science based reality,extended reality has grown from consumer space to corporate space.The future will belong to the XR when it comes to improving the task efficiency or the quality of the output of an experience for the user

1. In the military of the future simulations for training purposes and the critical data such as enemy location will be presented with the help of AR technology to the soldiers within their line of sight, which will also help pilots to position directly in the fighter's view which includes altitude,airspeed and horizon line in addition to another critical view.
2. With the help of augmented reality,the enhanced GPS can be used to make it easier for the people to get their directions from point A to point B(source of destination).Using the smartphone's camera in combination with the GPS , the user can look at the selected route over the live view in front of their car.
3. The augmented reality will help immensely to the people in the field of mechanics to make repairs to an engine so that they can see a superimposed imagery and information in his actual line of sight with the help of head worn display. The image of the necessary tool can illustrate the exact motion which a mechanic needs to perform.
4. AR technology creates simulations which will be used to train the technicians that can significantly minimise the training expenses.
5. With the advancement in technology,the computing power and gaming applications are on the upswing.
6. AR technology facilitates and accelerates the building processes at the factory. Light guide system willbecome one of the most common examples of manufacturing industry where AR technology is being used.

There has been a time when the cost of augmented reality was so substantial that the designers could only dream of working on design projects that are involved in it but now it has changed and is available on mobile phones as well.According to the experts,the AR market could be worth $122 billion by 2024 to mix the reality with fictions in images.AR technology has much more to offer to the industry than just the entertainment.By the year 2025,the healthcare industry will generate the revenue of around $5billion and some technology insiders expect to see the most advancement through AR. The travel industry is expected to boom as 84% of consumers worldwide,among which 42% believes that AR is the future of tourism.

VII. Discussionand Conclusion

There is no doubt that the XR technologies are here to stay and rule, the question is where and when to use them? In order to answer these questions practical experience and knowledge needs to be built up within the organisations.Different phases within assembly system use different XR technologies,such as:VR is very useful in the design phase, for example for factory layout planningof a new shop floor section, on the contrary it wasnot very useful in the operational phase since it is an immersive technology, the immersive technology also but demands on computer graphics and processor power in order not to lack and make the operators sea-sick.MR is the most flexible technology and could be used in almost every phase.This technology has the most potential for the future since it could be used in most phases. Since it is note immersive it has also a better user experience than VR technology.AR technology is certainly something for the future, but AR needs some further development before it can work flawlessly in industrial environments. Upgrading the design and the hardware are potentially the first steps to replace the existing ways of learning, quality check and instructions for maintenance work.Here is a graph showing the past and outperforming future of the extended reality technologies.
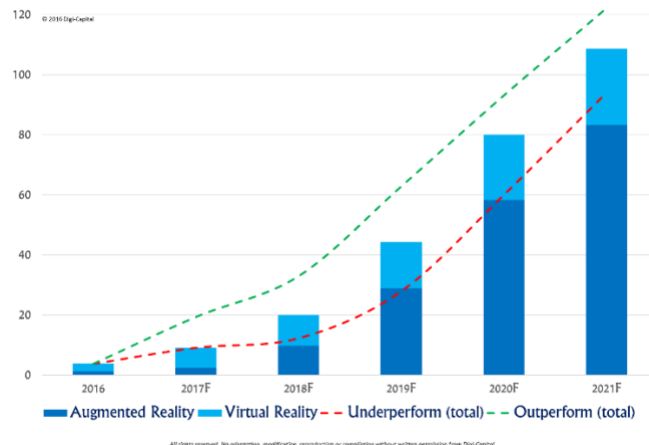

Figure 5: Performance of XR

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