

Module : Advance Industry 4.0 [ACPA7000]

Assignment 1 - Written Report

A key business model - "Augmented Reality (AR)"

Course : MSc Industry 4.0 Advanced Manufacturing

Supervisor : Mr. Mahesh Kannath

Prepared by

Student : Rahul Bhosale
(University of Wales Trinity Saint David)

Email: 2116970@student.uwtsd.ac.uk

Date : 08 Jan 2023

Table of Content

<i>Sr number</i>	<i>Description</i>	<i>Page number</i>
1	Summary / Overview	2
2	Introduction	2
3	Development of project	3
4	Literature review	3
5	Key determinants in the process	4
6	Current issues and understanding	4
7	Process and Technologies implemented	5
8	Concept and theories behind	5
9	Critiques of AR	5
10	Applications	6
11	Conclusion	8
	References	

List of figures

<i>Sr.no</i>	<i>Description</i>	<i>Page number</i>
1	Microsoft HoloLens - virtual aircraft engine.	2
2	Safran landing gear	3
3	AR Challenges percentage	4
4	AR in medical imaging	6
5	AR in Manufacturing and Assy	6
6	AR in Entertainment industry	6
7	AR in Tourism	7
8	AR in Teaching & Education	7

1. Summary / Overview

The below report is about Augmented reality (AR). It is a new business model leading to new sources of value to the process and new technologies with advanced industry 4.0 manufacturing. AR is the integration of digital information with the user's environment in real-time. Unlike virtual reality (VR), which creates a totally artificial environment and develops a feeling of a real atmosphere, the use of this technology experiences a real world with generated information included in it. This report study aims to introduce some of the industrial AR technologies to improve the capabilities, value addition for the operations & other thoughts of implementation with examples. Furthermore, it describes the key determinant, challenges with issues and various applications. It also provides a details about AR application in various industry as an innovation. SAFRAN aircraft seating industry had already implemented AR in their projects like landing gear repair and assembly.

2. Introduction

Augmented reality (AR) is the most interesting technology which is increasing nowadays in many small scales and big organizations to simply do their work. It shows the level of impression by combining the real world with the virtual in different proportions. AR is mainly used in various applications such as surgery, the inspection of hazardous environments, and engineering. Most of those systems operate indoors and cover relatively small areas, Further use of computer, vision, and wireless technology made it achievable to develop outdoor wireless systems to support complex analysis and processes.

As seen in the last several years private and government organizations are recognizing location information as a platform for improved service. It is very often seen that every people want to know the shop location, petrol pump, parking spaces, and the food stall. location of a shop, an office, a house, a petrol station or a hospital, the fastest way to home or another town and street, possibilities for traveling without waiting in traffic jams, etc. The contribution of this report gives an overview AR technology and its potential gains, benefits and advantages (Yunqiang Chen et al ,2019). Below image shows the example of working with hololens representation on a aircraft component .



Fig 1 : Microsoft HoloLens - virtual aircraft engine.

3. Development of project

Over the past year this technology is developed a lot. Due to this, there is a huge investment in mobile hardware, virtual experience with the metaverse (i.e. virtual reality space where humans can interact with computer generated environment), and industry competition. According to the research market due to all these variables, the augmented reality value has increased tremendously by around 67%. To be part of this percentage one should know all details about AR app development.

Development seen in augmented reality in 2022, which include the different technologies and the development flow. The augmented reality (AR) technology which is generated through the combine partnership shows it need in the product maintenance training for aircraft industry. Jamco America inline to venture business class seat, they have introduced latest AR technology to aerospace interior training and maintenance. They provide effective training through investing in AR technologies , previously they use to do this with written notes and face to face sessions (A D Hill, 2020).



Fig. 2 : Safran Landing gear

Safran had developed a HoloLens system for landing gears. The team able to show their product with virtual models experiencing fully mobile simulation enhancing bond with the client and growth of business. Work carried out directly from 3D files provided by Safran Landing Systems' engineers. These files / Data are in the form of CAD software CATIA which can't be open as it is , so they required the optimization phase. With our breadth of experience with 3D solutions and software such as Simpleton and 3DS Max, they been able to undertake this crucial part of the project. Technology used are Microsoft HoloLens , Microsoft Visual Studio 2015 , Microsoft Simplygon , C# , Unity 3D , 3DS Max , Tortoise SVN (Jeremy, 2019).

4. Literature review

The literature source for this review as per the social science index database which is a very recognized journal in social science. The time span and the document type was limited till 2016, The research method involves both qualitative and quantitative method of analysis (Y-H. Ching et al , 2013).

Historically AR technologies were not applied in construction sites, instead, they were used in offices. Due to more development, this is used in site for progress monitoring. Moreover, the trend shows that the web base and network technologies are more popular in recent years. The first description of AR as it is known today was in Virtual Light, the 1994 novel by William Gibson. In 2011, AR was blended with poetry by camera company in Tokyo, Japan.

5. Key determinants and AR Skills.

To have some understanding skills, the below investigations were carried out to gain knowledge. In terms of AR skills point of view. To design manufacture and support an AR, the company has to have experts engineer, scientists, mathematicians, doctors, and managers. They must be able to integrate Audio technology, Camera technology, Display technology, image processing techniques, manufacturing engineering, physiology, processor, and software engineering (L, Peddie, 2017).

6. Challenges and Issues with AR

Below are the listed challenges and issues for Augmented reality (Naveen Joshi, 2019).

6.1 Hardware issue

AR headsets have heavy/bulky hardware which may be too expensive for the masses. Majorly the headset needs to tether to the computer. Mobile AR games have a major issue in displaying visuals accurately.

6.2 Limited content

Creating augmented reality content to promote a business can be very complex and expensive. The content created consists of games and filters used in social networks such as Instagram and Snap chat.

6.3 Lack of regulations

Currently, there are no regulations to govern the usage of augmented reality. For instance, a cybercriminal can hijack personal account information by mining data output and manipulating AR content.

6.4 Public skepticism

Consumers are unaware of the benefits and applications of augmented reality. People have used the most popular application such as glasses. A lack of awareness may lead to concerns about privacy and security.

6.5 Physical safety risks.

AR application can be distracting and may lead to physical injuries. for example, people were injured while playing Pokemon. This application may lead to injuries if used in risky environments like roads, construction sites, and medical institutions.

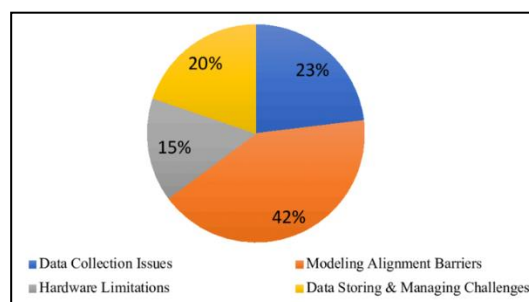


Fig. 3 : AR Challenges Percentage

7. Process and Technologies implemented

The key technologies of Augmented reality are as follows, which play a very important role in AR (Yunqiang Chen et al , 2019).

7.1 Intelligent display technology

According to the available data, more than 61% of human beings incorporate their own ideas to interact with the real environment. With the development of this intelligent display technology, AR is pushed at a high level in terms of display devices. there are specifically three categories of display devices, the first one is Helmet display (HMD) developed by professor Ivan Sutherland which makes it possible to superimpose simple graphics constructed by computers on real scenes in real-time. The second helmet-mounted display is a hand-held display that is very light, small, and especially for smart phones. The third display device is the PC desktop display, which matched the real-world information to the 3d virtual model which is displayed by the desktop display.

7.2 Registration technology 3d

This technology enables virtual images in a real environment. There are two main steps in this process, the first determines the relation which includes - Relation, Direction, and Position, The second one is the virtual image data proposed in a real environment. The various ways of this technology are registration technology which is mainly based on hardware tracker.

7.3 Intelligent interaction technology

This technology is very closely related to intelligent display technology, 3d registration technology, and other disciplines. The various interaction in AR includes hardware device interactions, location interactions, and tag-based or other information-based interactions. With the development of this technology, AR is not only with virtual information to real scenes, but also realizes the interaction between people and virtual objects in real scenes. It depends upon the instruction given by people.

8. Concept and theories behind

Augmented reality (AR) is an experience of the physical world with computer-generated input. inputs are created for sound to video, to graphics into GPS overlay which changes the user environment. the theory is that the animated object moves around a 3d world interacting with each other and with the stationary object. The first AR technology at 1968 at Harvard when AR head-mounted display system was created by scientist Ivan Sutherland (AR Technology, 2016).

9. Critiques of AR

In line with the criticism. The point of concern is loss of privacy, crime, and the digital divide. As with all Smartphone's augmented reality involves geo-location. the users which are into it allow the application to locate them. this may cause more collection of data. for example, when we go to the internet the website leaves some cookies on our system, this will help the marketer to check out like and dislike. They can reach us easily by targeting us the relevant advertisements. Now with this geo-location marketers will get to know more data about themselves which may lead to data privacy issues (Franziska Roesner, 2014).

10. Applications

The common device used for Augmented Reality are Mobile devices with camera feature such as iPhone or Android. A head mounted display HMDs (eg: glasses or lenses) attached to network. A PC or Mac with webcam (Hayes G ,2009). AR is included in our day to day life , where we have already come up with its applications when we travel , study, work , play and other activities as well.

10.1 Medicine

AR technologies are valuable tools in the medical industry, They have made patient data and their medical data in the same space. The first AR application in medicine in year 1986 where the system was integrated data from computer into a operating microscope was proposed (T. Sielhorst et al 2008).



Fig. 4 : AR in medical imaging

10.2 Maintenance and Assembly

AR plays an important role in the application of maintenance procedures. This supports through the assembly task and repair of an industrial device and 3D assets. This technology is now widely used in the assembly procedure of aerospace products during assembly and repair (S. Henderson, 2011).

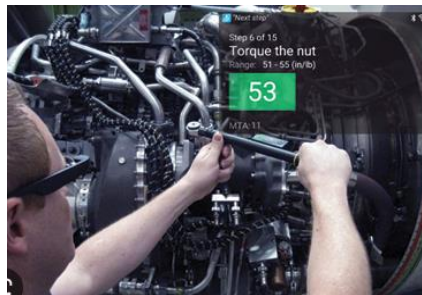


Fig. 5 : AR in Manufacturing and Assy

10.3 Entertainment

The entertainment industry is one of key player of technology progress and a much improvements in augmented reality can be related to it. Video games is one of it and more popular in today's world. AR aims to connection between real and virtual, which provides n user a new game experience. For example , you can experience real feeling while playing any sport on connected TV. AR plays also a very important role when advertisements and logos have to be inserted in live video broadcasting.



Fig. 6 : AR in Entertainment industry

10.4 Tourism

AR's key role in tourism mobility's and improvement is seen by new generation Smartphone's and tablets. In tourism the application shows the user's location and the selection of points of interest in the nearby area like museums, restaurants, accommodation, and transport. AR improves the fictionalized landscape visits.



Fig. 7 : AR in Tourism

10.5 Teaching, education and training

AR technology changes the way of approach towards the user and the machine's interaction, which stimulates the students to study the course material in different ways & they can be more proactive. the AR book which is also called the magic book is the are the best example of interactive material: some pages present animations, audio content, and 3D objects (H.-Y. Chang, 2013).



Fig. 8 : AR in Teaching & Education

11. Conclusion

Augmented reality implementation will lead to improving recruitment by hiring less qualified workers because training for this specific task will be easier & learning time will be considerably less in terms of the conventional way with minimum training cost. The efficiency of work will be increased with minimum defects.

The early detection of non-conformities or any assemblies error can be avoided which results in a cost saving of rework later. Reduction in inspection time and increasing the quality of the product. AR applied to the aerospace manufacturing industry will improve the process, faster production, higher quality, and reliability for the production processes which increases the company's value in the market.

This Augmented reality is a new business model having various forms and a wide range of applications as listed in this report. This leads to value addition to the new and emerging Industry 4.0 technologies. Also helps researchers and developers to decide appropriate technologies for application in small scale manufacturing industry.

References:

1. Yunqiang Chen *et al* (2019), "*Journal of Physics: Conference Series, Volume 1237, Issue 2*" Available at: <https://iopscience.iop.org/journal/1742-6596> (Accessed: 17/12/2022). UK : IOP Publication.
2. Y.-H. Ching *et al* (2013), "*Trends of educational technology research: more than a decade of international research in six SSCI-indexed refereed journals*," *Educ. Technol. Res. Dev.*, vol. 61, no. 4, pp. 685–705. Germany : Springer Nature.
3. Rankohi Sara *et al* (2013), "*Review and analysis of augmented reality literature for construction industry*". Available at: <https://doi.org/10.1186/2213-7459-1-9>. Germany: Springer Nature.
4. L, Peddie (2017), "*Augmented Reality*", DOI 10.1007/978-3-319-54502-8, USA : Spring International publishing.
5. A D Hill, (2020), Article- in news" *AR-innovation-for-aircraft-seating-mro*". Available at: <https://www.jamco-america.com>. (Accessed: 03 Jan 2023)
6. Hayes G (2009), "*16 Top Augmented Reality Business Models*". Available at : <http://www.personalizemedia.com/16-top-augmented-reality-business-models/>. (Accessed: 02 Jan 2023)
7. T. Sielhorst *et al* (2008), "*Advanced medical displays: a literature review of augmented reality*," *Journal of Display Technologies* 2008, vol. 4, no. 4, 451-467. DOI: 10.1109/JDT.2008.2001575 :IEEE (Accessed: 02 Jan 2023).
8. S. Henderson (2011), "*Exploring the benefits of augmented reality documentation for maintenance and repair*," *IEEE Transactions on Visualization and Computer Graphics* 2011, vol. 17 , no. 10, pp. 1355-1368, DOI: 10.1109/TVCG.2010.245. (Accessed: 31 Dec 2022).
9. H.-Y. Chang (2013), "*Current status, opportunities and challenges of augmented reality in education*," *Computers & Education* 2013, vol. 62, 41–49. Available at : <https://www.learntechlib.org/p/132254/>.(Accessed January 4, 2023)
10. Naveen Joshi (2019), "*Challenges with augmented reality*". Allerin 22 Aug 2019, Available at : <https://www.allerin.com/blog>. (Accessed : 04 Jan 2023).
11. Jeremy (2019), "*Development of HoloLems application for landing gear visualization*". Safran Landing system, Available at : <https://www.actimage.com/en/credentials/safran-landing-systems-application-hololens>. (Accessed : 04 Jan 2023)
12. AR Technology (2016), Online Wikipedia, Available at : https://en.wikipedia.org/wiki/Head-mounted_display. (Accessed : 06 Jan 2023).
13. Franziska Roesner (2014), "*Security and privacy for augmented reality system*" *Communications of the ACM*, vol 57, issue 4, DOI 10.1145/2580723.(Accessed: 1 Jan 2023).