Augmented Reality as one of the effective solutions to strengthen the link between design and production

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Introduction:

Augmented reality technology has become increasingly popular, due to the ease of developing applications and the wide use of digital devices (mainly smart phones and tablets) that are able to support this technology. An increasing number of applications based on augmented reality solutions are being developed for industrial purposes. Although these applications are often little more than experimental prototypes, augmented reality technology has proven to be very flexible and shows great potential in many areas (for example maintenance, training / learning, assembly or product design) and in industrial sectors (for example automobile, aircraft or manufacturing industries). It is also expected that augmented reality systems will become more widespread in the near future.

Research problem:

The research problem lies in the fact that productive institutions have encountered problems in the process of communication and exchange of information between multiple production points that spread around the world, especially with the multiplicity of languages, cultures and time differences ... etc. Manufacturing and assembly in an optimal manner, with the required quality, which must be done quickly within the life cycle of the product during its production, from design and planning for production to manufacturing and assembly.

Research objective:

Standing on what augmented reality is, its origins, and its applications, to highlight the possibility of using it as one of the effective solutions in the process of communication and information exchange between multiple production points.

Force search:

If augmented reality is included as one of the effective solutions to treat the problem of communication and transfer information between production points, this will contribute to raising the efficiency of workers and increasing the quality of products and thus raising the competitiveness of companies and institutions.

Research Methodology:

The research follows the descriptive and analytical approach, through collecting, analyzing and extracting information in order to achieve the goal of the research.

Research topic:

First: what is augmented reality technology?

Augmented reality is a relatively recent term, so there are many terms and synonyms that refer to this term, including (enhanced reality - added reality - augmented reality) and all refer to augmented reality, the reason for the multiplicity of these terms is due to the textual translation of the word augmented reality from the English language.

1) Augmented Reality Definitions.

• Asuma (1997,365) defines augmented reality as: "a simultaneous interactive technology that integrates real-world properties with the virtual world in two-dimensional or three-dimensional form."

• Dunlifi and Dede (Dunleavy, Dede, 2006, p.7) define AR as: "a term describing a technology that allows simultaneous mixing of digital content from software and computational objects with the real world".

• (Larsen, Bogner, Buchholz, Brosda, 2011, p. 41) defined it as: "adding and synthesizing digital data

• It is an imaging and using digital methods of the real reality of the environment surrounding human being, and from a technical perspective, augmented reality is often associated with wearable computers or smart devices that can be carried.

From the above, it can be noted that the term augmented reality refers to the possibility of integrating virtual information with the real world, when a person uses this technology to look at the surrounding environment around him, the objects in this environment are equipped with information that swim around and integrate with the image that the person is looking at. Technical development has helped a lot in the emergence of this technology, so we see it in personal computers and mobile phones, after it was the preserve of research laboratories in large companies.

Perhaps the most famous example of augmented reality technology is the Pokémon Go mobile app, which was released in 2016 and quickly became popular. In this game, players locate Pokémon characters that appear in the real world and pick them up from the real places in which they live (on the sidewalk, in the fountain, and even in the rooms and bathroom of the house). Apart from the games, there are many uses of augmented reality in our daily life.

2) The concept of augmented reality.

Augmented reality (AR) is an experience in which designers optimize parts of the physical world for users through computer-generated input. Designers create inputs from audio to video to stereoscopic graphics with the ability to integrate it into a Global Positioning System (GPS) and more digital technologies that monitor changes in the user's environment in real time.

• Augmented reality is an enhanced version of the real physical world through the use of visual elements, sound, or other sensory stimuli.

It is a growing trend among companies working in the field of mobile computing and business applications in particular, relying on data collection and analysis, which represents one of the basic goals of AR in highlighting specific features of the physical world, increasing the understanding of these features and deriving intelligent, accessible and applicable insights. On real world applications. Big data like this can aid in corporate decision-making and many other things.

In other words, augmented reality represents an interactive, participatory synchronous technology that uses digital devices to add data to real reality in the form (pictures - writings - media - video clips - links) with different shapes, dimensions and multiple measurements.

Second: How does augmented reality technology work?

Augmented reality can be divided into four main phases, which make incorporating additional content into the real world possible.

1) AR captures a portion of the real environment using a camera on a smart phone, tablet, or head-mounted display (HMD).

2) Then it scans the captured segment from the environment to locate a point where additional information is superimposed using markers or tracking devices such as infrared, lasers, GPS, or sensors.

3) Once this point is identified, augmented reality requests pre-defined content to overlay the ecological footprint with additional information from the database.

4) Once the necessary content is requested, augmented reality forms a complete picture consisting of a realistic background and virtual data overlaid, combined and simultaneous interaction.

Third: the characteristics of augmented reality.

• Mixes the real, virtual, in a real environment.
• Interactive as to be at the time of use.
• Three-dimensional 3D.
Provides clear and accurate information.
• The ability to enter information in an easy and effective way.
• The possibility of interaction between two parties, such as (teacher and learner).
Although simple to use, it provides powerful information.
• Make complex procedures easy for users.
• Cost effective and easily expandable.

Fourth: Augmented Reality and product development support.

The product development process is a long and resource-intensive process that requires constant communication between several parties and involves many reviews, all of this happening before the development reaches production and manufacture.

The development process faces many obstacles that may lead one of them to return the whole process to the starting point, perhaps the most prominent of which is what takes place after the end of the design stages for development and access to prototypes from the process of presenting new designs to the decision-makers for production approval by the institution's senior management in addition to marketing and market study officials. As well as production managers and procurement officers for raw materials and others.

Augmented reality reduces the boring nature of this process by simplifying cooperation between stakeholders. For example, company managers and others can see the product under development in real time using devices that support augmented reality technology, and allow them to provide advice and ideas, which results in their inclusion in the development process, which helps speed decision-making and prevents the emergence of obstacles that lead to the

stoppage of the process development or return as a result of delaying feedback until the entire process is completed.

Fifth: Augmented Reality and support design stages.
The use of augmented reality technology supports many stages of product design and development, including:
1) Bring the proposed new design into the current reality.
The designer begins the stages of the product design or development process by imagining and developing a hypothetical conception of what the product should be in the future, and in order to achieve this, the designer develops perceptions of the product concept and user experiences and works to integrate them and develop a formation through manual drawings and computer programs that support design and modeling. In order to access a digital 3D model on computer screens.
But the hypothetical model accessed on screens or on graphics paper is often separated from the realities of size and spatial context in the real reality of the user environment.
Augmented reality allows extracting the idea from the screen and integrating it into the real reality in a more real way. This enables to deal with the product and walk around or inside it and get a much better feeling in terms of shape, proportion and relationship with the surrounding environment, which gives a greater opportunity to develop a correct perception of what it will be upon the product after its implementation and production that results in greater opportunities for development and design treatments in its early stages.
2) Measuring user reactions.
The use of augmented reality in extracting the design from the computer screen and integrating it into the real world helps to measure the percentages of customer demand for the product when it is integrated into the markets, as it is possible by using technologies and applications of augmented reality to develop the proposed new design between the products of competitors in the real environment of the markets, follow-up of customers and measure uptake on the new product, as well as the reactions to it and their observations on it, which reflects a pre-indication of the expected purchase percentages of the product as soon as it is manufactured and put on the market, all of that and the product is still in the initial design and development stages.
3) Flexibility in development processes.
Augmented reality allows great flexibility in the design development processes and simplifies them, especially when compared to traditional methods of development after modeling, as the development process requires the use of a variety of tools at different times to reach the required development.
The development process can be supported by using augmented reality, as a wide range of options and alternatives are discovered using virtual means, which reduces costs in research, development and experiments in traditional methods and allows for modification, development and iteration at a faster pace. With the support of 3D printers for the output of augmented reality, the production of 3D models has become a fact, it is faster and more flexible than conventional operations allow.

Sixth: Examples of augmented reality application fields.

1) Logistics service.

The logistics industry extensively uses augmented reality capabilities in various business operations including smart warehouse management and supply chain.

Augmented reality is now greatly affecting the digital transformation of the entire sector across the globe. For example, DHL uses augmented reality goggles to improve worker efficiency while picking materials from warehouses.

This tool shows workers a virtual selection list and provides them with the most convenient way to reach the location of the desired item, which saves time. In addition, once the worker is in the right place, smart glasses help him quickly find a specific package on the shelf by scanning the barcode.

2) Training of corporate employees.

Augmented reality technology is able to take company training to the next level by enabling employees to obtain accurate data in real time.

With smart augmented reality glasses or head-mounted displays, professionals can test their skills on the job without the risk of damaging company property or making a mistake that could lead to financial losses.

Moreover, junior workers can receive assistance in real time, which is especially helpful for emergencies or unforeseen issues.

Augmented reality also helps engineers and other technical professionals perform complex operations with a digital checklist or hands-free guide.

3) Augmented Reality in Retail Operations.

Augmented reality has great advantages for both e-commerce stores, and augmented reality technology virtually eliminates the main drawback of online stores - the inability of customers to interact with a product they are considering buying. With the AR app, customers can navigate more efficiently through the aisles of the store in search of a shelf and giving access to the desired product.

In addition, with the application of virtual reality technology, store visitors no longer need to change the same type of product to choose the color they prefer. Instead, they can take just one object, point a smartphone's built-in camera at it and see how it will look in another color.

4) Augmented Reality in Healthcare.

Augmented reality can be a very effective tool for surgeons and other medical professionals. Augmented reality technology simplifies intervention planning tasks by showing medical staff real-time data such as ultrasound or CT scans.

Smart augmented reality glasses can also provide surgeons with vital information about a patient's health in the form of 3D objects while enabling specialist doctors to use their hands without having to search for necessary data during the intervention.

Moreover, the augmented reality allows surgeons to engage their colleagues with experience in the surgery even if they are in another part of the world which reduces the error rate and helps surgeons to save more lives.

5) Augmented Reality in Military Operations.

Tactical Augmented Reality (TAR), is essentially a lens that helps soldiers to precisely locate their positions as well as the locations of others (friend and foe). It gives soldiers a better awareness of the situation using AR technology. TAR will replace night vision goggles,

enabling soldiers to see in the dark. It will also replace the portable GPS that soldiers carry today to determine their locations. The lens is connected wirelessly to a tablet that soldiers wear on their waists, plus it is wirelessly connected to a thermal position attached to their rifles. If the soldier points his weapon, the image of the target can be seen, in addition to other details, such as the distance to the target, through the virtual reality lens.

Findings and recommendations:

First the results.

• Augmented reality is a suitable solution to support the process of communication and transfer of information and interconnectivity between various production points within the production institutions with the spread of their sites.

• The use of augmented reality technology in supporting each of the design and production stages leads to raising the efficiency of workers, saving time and expenses, increasing the quality of products and raising the competitiveness of productive institutions.

• Augmented reality technology does not interfere with the digitization and integration of robots in the production stages, but rather supports and benefits from them.

• Familiarity with students and industrial design practitioners of augmented reality technologies and support for its renewable applications on a daily basis will lead to raising the designer's efficiency and the quality of the designs presented and their keeping pace with technological development.

Secondly, recommendations.

• The necessity to amend the academic regulations to raise the efficiency of students and practitioners of designing products through the inclusion of new technologies in the curricula and training on their use during the study stage.

• The necessity for governments to study ways of changing the conscious mind to move towards technical and technological education.

• The need to develop the technological infrastructure to support the inclusion of augmented reality technologies in local industries.

References:

1) muhamad , tariq , 'asalib mubtakarat fi altaswiq al'iilikturunii almueazaz wa'atharuha fi tasmim almuntajat ", majalat aleimarat walfunun waleulum al'iinsaniat , almujalad 4 , aleadad 17 , sibtambar w 'uktubar 2019 , alsafhat 335-348.

2) qunsuwat , maruat eabd almuneim , "tasimuym tutbyqat alwaqie almueaziz alnamat alqiasii min ajil almithal ealay almithal , ealy alajihizat alalktrunyt wa'atharuha almutalaqiy" , majalat aleimarat walfunun waleulum al'iinsaniat ,

1. almujalad 3 , aleadad 12 (2) , alkharif 2018 , alsafhat 460-476.

2. F. Doil, W. Schreiber, T. Alt and C. Patron, "Augmented reality for manufacturing planning", *7. International Immersive Projection Technologies Workshop*, 2003.

3. Hu Tianyu et al., Overview of augmented reality technology. Computer Knowledge and Technology, 2017(34): 194-196(in Chinese).

4. J.-H. Chen, W.-Y. Chen, and C.-H. Chen, "Identification recovery scheme using quick response (qr) code and watermarking technique." Applied Mathematics & Information Sciences, vol. 8, no. 2, 2014.

5. T. Alt and S. Nölle, "Weite Welt – Augmented Reality in der Automobilindustrie", *iX – Magazin für professionelle Informationstechnik*, no. 5, pp. 142-145, 2001.

6. https://www.interaction-design.org/literature/topics/augmented-reality

7. https://helpx.adobe.com/mena_ar/aero/using/what-is-augmented-reality.html

8. http://msensory.com/a-brief-history-of-augmented-reality-future-trends-impact-learn-g2-com/

9. https://www.adobe.com/insights/5-realworld-examples-of-augmented-reality-innovation.html

10. https://www.newgenapps.com/blog/augmented-reality-apps-ar-examples-success/

11. https://www.prescouter.com/2019/05/what-are-the-applications-of-augmented-reality-ar-in-manufacturing/

12. https://www.jabil.com/blog/augmented-reality-in-product-design.html