Research Avenues on use of Augmented Reality in Education

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Abstract

The use of Innovative technology in education enhances the grasping ability of the student to gain knowledge proactively and provides a platform for a constructive process of learning and understanding. Augmented Reality (AR) plays an essential role in active learning and critical thinking in the current information age because technology enables students to interact with the virtual world with an immersive experience. Moreover, the integration of AR in education has attracted researcher's attention towards AR due to its immersive, naturalistic experience. Augmented reality plays a vital role in Medical Science, the Aviation industry, the Advertising industry, the Printing Industry, Maintenance, Tourism, Education, the Automobile industry and many more upcoming industries. The use of AR is going to be spread in the coming days. This paper comprises an overview and the study of augmented reality in different sectors. On emphasising the uses of AR in the education field, to give a real-life interactive experience to the user on his mobile. The review narrates the ability of AR, and applications of AR in the field of education such as science education, Industrial training, and biomedical education. The review summarises the potential of technology integration.

Keywords: Innovative Technology, Constructive Process, Augmented Reality, Education, Research Avenue, Printing Technology

1. Introduction

Conventional teaching is the process of undeviating information transfer from the teacher to the students in PowerPoint, discussion, question answers, role play etc.[1] Students may not be able to get in-depth knowledge and a clear understanding of the topic. According to the ability to intensify the hypothesis, students will clearly understand the topic with 3D visualization of concepts. Students can grasp things quickly with a computerized visual effect, and it will be helpful to the teachers to assess the students for their taught subjects.

Augmented Reality (AR) is an Innovative Technology (IT) that can superimpose virtual phenomena into real-world phenomena. AR permits viewing the virtual phenomenon with scenes from the real world using portable devices such as computers with cameras and notebooks, smartphones etc. AR can be explained with 3I and 3A .3I is Immersion, Interconnection, and Implicate, where Immersion is affection for a presence inside the surroundings, and Interconnection is for the ability of computing devices to catch user input and immediately alter the virtual world. Implicate is for encouragement to fascinate somebody with specific movements. [2] This can be done at any time, anywhere, and anyone can experience the extremely interesting world of AR. AR can exaggerate the learning experience of the students. [3] AR aids in understanding things quickly and effectively. Nowadays, AR is a crucial part of education; therefore, many researchers have focused on AR for their research works. Because of this, the use of AR is increasing exponentially across the world.

Innovative Technology (IT) has set an optimistic impact on education. Technology use in education includes simulation of theory, real-time issues, and communication with professionals

at remote locations. Education taken through the integration of IT becomes more popular due to its live experience and naturality than the conventional teaching-learning process. [4]

This article will give insight into the AR of various sectors and strongly recommend using AR to simplify things. AR improves the quality of the teaching-learning method by helping students to learn new things in more effective ways 24/7. It helps medical practitioners to diagnose diseases by using AR technology. In the tourism industry, to give an overview of the places by AR.

2. Overview of Augmented Reality

In simple terms, AR is a superimposition of computer graphics in the real world. AR falls in between VR and telepresence. While designing AR, three steps are essential, 1) combining the real world and virtual world 2) it must be interactive in real-time 3) registration in 3D. Whereas in VR, computer-generated virtual worlds allow users to enter and interact with a fictitious world. It gives an immersive effect to the user in a factious world which feels like the real world. [5] Telepresence allows users to feel as if they were present. Telepresence is a combination of human and machine systems in which human operators receive the information of teleoperators in such a way that the communication that occurs between them feels like the operator is physically present and is almost real. In VR, the real world seems like a virtual world, whereas, in telepresence, the virtual world seems like a real world. However, in AR, objects are augmented in the real world. Due to device limitations in virtual reality, the fourth aspect, portability, was introduced in the AR to overcome portability through which users can move around the large environment. AR has three basic components such as scene generator, tracking, and display. AR can be classified as per the display devices: optical see-through, virtual retinal system, video see-through, monitor-based and projector-based AR. In optical see-through devices, transparent head-mounted devices are used to see the virtual world projected on the real world directly. The problem of HMD is about the alignment of optical and real data, which is being diminished. [5]

AR in human anatomy education may help to identify tissues and structures of anatomy. The computerized created 3D virtual body parts are superimposed on the real-world human body, so that understanding and grasping of students can increase widely. [2] Learning anatomy with AR makes anatomy realistic based learning. Figure 1 shows a basic overview of the virtual world in the real world.

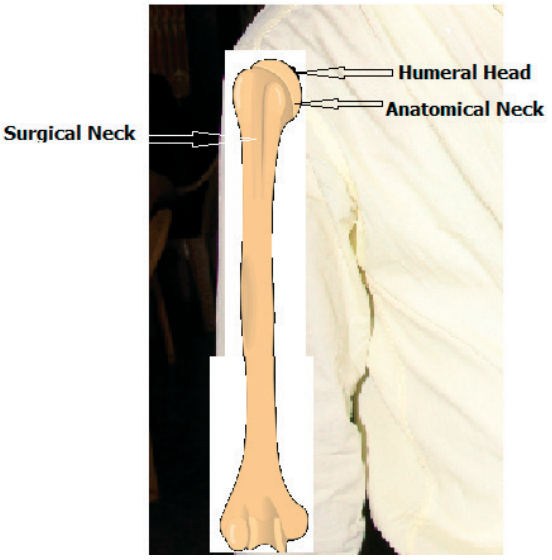

Figure 1: Virtual Object superimposed on a real body

Innovative ways applied in education, students experience high satisfaction in understanding concepts, having fun, and being willing to do experiments frequently with AR. Students get immersive experiences. [2]

In the 1960s, a pioneer of computer graphics, Evan/Ivan Sutherland, proposed virtual reality in front of the World through Head Mounted Device. He was the first person who proposed Head Mounted Device in 1968 that can be used in VR systems. It is later used by U.S. Military helicopter pilots. [6]

Later in the 1990s, a scientist from Aircraft Manufacturer Boeing developed an AR system to help electricians with complicated cable assembly. The AR system blended virtual cable assembly onto real-world environment display, which assists their electricians in cable assembly. [6]

3. Research Avenues

This paper mainly focuses on Research Avenues on the use of Augmented Reality in Education. We referred a total of 62 indexed journal papers

based on the use of VR/AR in education, out of which we have excluded VR based systems used in education.

3.1 Augmented Reality in Science Education

Science Education, specifically earth structure, molecular geometry, is hard to grasp because of its monotonous structure. Integration of IT with science education can be considered as a constructive process of education. Authors in the paper have given two effective and crucial ways to learn the science, which are Image-Based (IB) AR and Location-Based (LB) AR. IB-based AR is marker-based AR that uses particular labels to position 3D phenomena on the real-world image. The virtual object is created on the computer monitor by changing the movements (tilting and rotating) of the AR Book, which is featured with webcam and marker labels. LB is based on Global Positioning System (GPS) to recognize locations and augment the computer-generated messages on them (illustrated in Figure 2). [6]

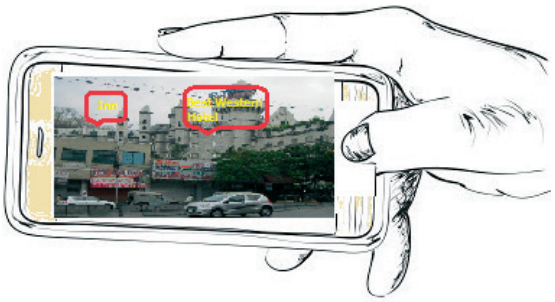

Figure 2: Location-Based AR

AR made science education easy to understand, learn and locate things in an effective manner. There is still a need to investigate learning experiences with the existing systems, which can become an important loophole from where researchers can start research in science education.

3.2 AR in Medical Education

The potential of projected AR system to improve medical education. Software algorithm and commercial off the shelf components used for prototyping the P-AR system for nursing education content. The survey was conducted using Likert scale for evaluating the P-AR features in terms of engagement, effectiveness, usefulness, user friendliness and realism. The education of complex process of pressure injury will be benefitted by using P-AR simulation technology. The result shows that the P-AR has potential to enhance the effect of teaching and learning in pressure injury in nursing education. [7]

The tracking camera integrated HMD used for spine navigation. The Head mounted device allows user to navigate and visualize the surgical data concurrently in the same field of view. The 60 years old female patient case were presented with a grade 1 spondylotithesis and severe spinal stenosis and were treated with an L4-L5 interbody fusion. The endoscopic part of the surgery of the patient was performed with the help of AR-HMD system. The spinal stenosis and degenerative spondylolithesis treatment are effective after successful used of full endoscopic transforaminal interbody fusion under conscious sedation. The procedure of spine surgery has steep learning curve and requires robust understanding of foraminal anatomy. The use of AR in spine surgery will enhance learning efficacy of user. The safely and precision of endoscopic spine surgery is greatly improved by the use of AR. [8]

Focus on one task and execute that task at a time is one of the expressions in medical education, which every student will follow to become a good professional, and that will go on. [3] AR is already used in medical education, specifically in surgery; anatomy, psychology, dentistry, limb rehabilitation, Phlebotomy, and the list go on. Various researchers conducted a study to discover the constructive AR applications in medical education. AR made the learning process easy. Human anatomy is a composite thing with many connected parts, tissues anatomical structures. It is hard to learn anatomy with conventional teaching methodology. It takes more time to learn and understand it in detail. Author Sharon Farra at. el., shown that Disaster training conducted for nursing students through the immersive simulation intervention is more effective than purely web-based disaster training. [9] The study is carried out in two groups of nursing students in two months' time frame. The study shows a strong effect of retention of disaster training. Immersive simulation

sharpens the decision making and critical thinking of the learner.

Traditional education is time-consuming and costlier because, according to the student's understanding, teachers have to spend more time in content delivery; it is costlier because of personnel cost, infrastructure cost has to include. An immersive experience in education through immersive simulation experience over the traditional medical education is comparatively inexpensive. [10]

3.3 AR in Technical education

The traditional method of teaching might be boring. AR is helpful for teaching and learning processes to improve the quality of teaching in the form of understanding concepts, visualizing the concept, remembering the concept, etc., instead of the traditional chalk and talk method. AR gives immersive effects to the learner to understand the concept by visualizing the concept. The author studied the various fields of education which applied AR methods for their field and explained the brief advantages of AR in education. [11] Engage the students to learn new things with visual effects makes them interactive and more excited. [12] According to the study, AR forms a bridge between formal teaching classrooms to the outside classroom environment.[13]

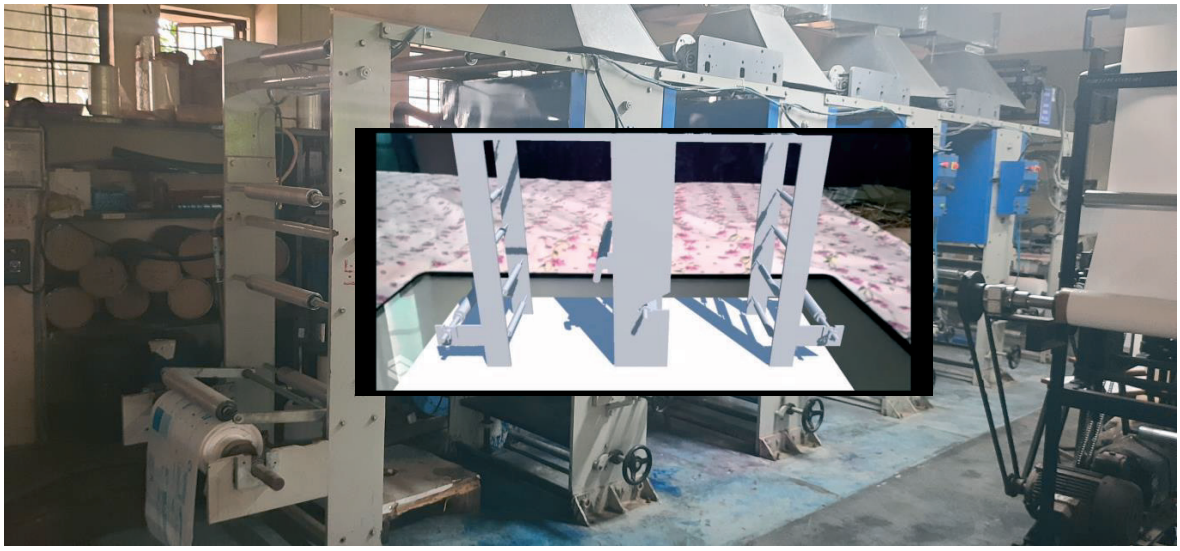

Figure 3: Web fed four-colour gravure printing machine with superimposed machine framework using AR

3.4 AR in maintenance

The proposed system help to validate its efficacy for a pipeline operation and maintenance management system by using building information modelling (BIM), geographical information system (GIS) and augmented reality and application programming interface and cloud database. This system can assist the decision making by using more realistic 3D visualisation, geographic and inspection information, and data retrival. The comprehensive management and maintencace stsyem is becoming more important in maintence underground utilities in safe condition. The exhisting method of maintencance system of underground utilities has several problems such as lack of a digitised 3D model, comprehensive database and editable data on site. The performance of POMMS were investigated by using two case studies and one survey. It is found that the tow case studies and survey helps shows the of POMMS's efficacy in improving the data collection, communication among stakeholders and perceptions along with revealing the critical challenges and limitations implementation of AR. [14]

This paper investigated the effect of different mode of AR such as information mode and interaction mode on maintenance assembly. In information mode video verses animation and in interaction mode hand gesture verses voice command were analysed based on user performance, workload, eye gaze behaviours and usability during maintenance assembly task. The finding shows that the 3D animation improves almost 14% task completion time over the video instructions. The issues such as misguidance

and overreliance highlighted by user perceptions must be considered and addressed from the joint cognitive systems (JCSs). [15]

This study proposes a new AR system such as MANTRA with specific application to industrial maintenance. According to the study, the proposed AR system align virtual information and temperature automatically on any 3D object in real time using RGB-D sensor and an IRT camera which can provide high accuracy and robustness. Posture based estimation method combines a deep learning-based object detection method and YOLVO 4 with the template based LINEMOD pose estimation method and model based 6DOF posture tracking techniques. The effectiveness of the developed system validated with quantitative and qualitative obtained through real use case. [16]

The author has addressed the emerging challenges in developing robust maintenance support tool with the help of design and developed framework for the remote maintenance support and repair operations based on AR. The suitable communication channels from shop floor technicians and the expert engineers were developed based on real time feedback from the operator's field of view. The developed framework was tested on lab-based machine and in using real life industrial scenario to check its applicability. [17]

Furthermore in 2020 the author presented AR using product design framework which provides digital platform for connecting engineers to customers. For supporting file exchange and storage participants will design a and developed a cloud platform which will be the communication layer between the stakeholders. For the end user, with the help of AR product design were developed as per the product customisation and visualisation. The developed framework was used to gather the information about skills and competencies acquired by the participants during the development of the project.

In the automotive industry, carrying out a complex assembly task using a user manual can devastate maintainers' minds, resulting in low-quality performance. The author followed several stages in this article, including designing a 3D model, applying animation, creating a building scheme, and installing software. Unity 3D platforms were used to develop an application, and Vuforia, the open-source software, was used to develop a tracking system where 10 participants were selected and divided into two groups, and each group was assigned tasks such as paper-based tasks and AR-based tasks. [18]

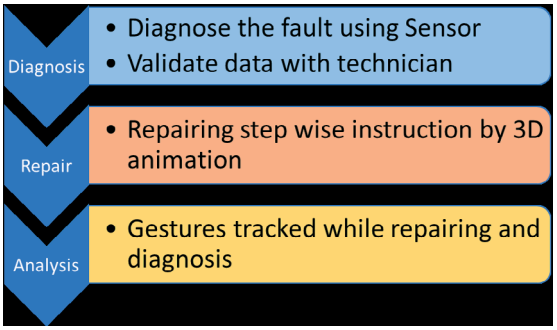

Figure 4: AR integration framework for Maintenace system [18]

3.5 AR in advertising

This study analyses the effect of Experience economy dimensions such as satisfaction and behaviour intentions in online stores on Augmented reality advertising. The primary data from 230 respondents who have used a online mode shopping using Augmented reality features were used for analysis. SEM (structural equation modelling) using AMOS program were used as analytical tool. The result shows that the Escapism dimension influence the augmented reality Ad satisfaction. The purchase intentiona in online stores affected by the shopping experience shared by users with their social community because there is correlation between the augmented reality ad satisfaction to the shopping enjoyment and shared social experience. [19]

The article focuses on the use of Augmented reality to support product evaluation before buying and explore its effect on sales on online shopping. The finding shows that the mobile AR app is connected with higher sales for brands that are less popular, expensive and less appealing from the data obtained from international cosmetics retailer. AR is effective on customers those are new to the online channel or product category. The sales increases from online platform adoption and category expansion. The AR is most effective when product uncertainty is high, the potential of technology can be used to increase sales by reducing

uncertainty and inculcate purchase confidence. [20]

The study investigated the uses of AR mobile app advertising for enhancing AR experience. The psychological mechanisms of mental imagery such as narrative transportation (in response to ad storytelling) and spatial immersion were used for investigating the role of escapism by analysing its antecedents and consequences. AR mobile app advertising provides platform for interactive consumer engagement to enhance advertising efficacy and provoke positive consumer responses. Positive social media sharing, purchase intention through brand attitudes, and brand engagement through AR mobile app advertising used for gathering data under escapism experience to understand its consequences. The findings shows that the prior brand preferences does not influence the relationship between escapism and consumer responses after exposure to immersive AR advertising which can be used to enhance the escapism in the context of AR mobile app advertising. [21]

The AR advertising tools are useful to covey the information about projects and services to the customers, which will achieve advertising objectives. Whereas in traditional advertising methods, especially banners and streamers, which are usually in the form of text and images non-interactive and can only attract attention. Various advertising applications can be developed using Unity 3D and Vuforia software, useful for smartphones. [22]

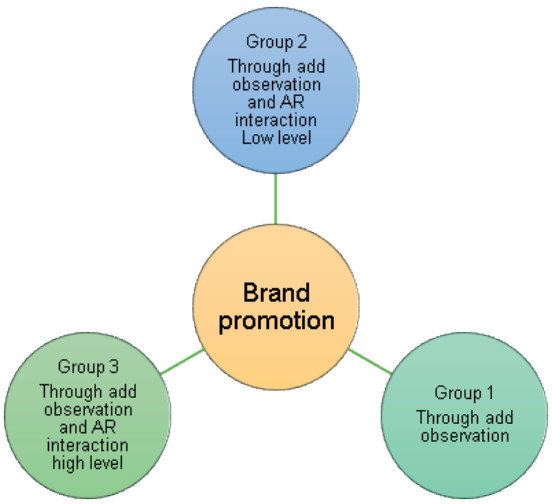

Figure 5: Experimental model to analyze the effect of AR interaction in advertising [22].

3.6 AR in tourism

The efficiency of AR for boosting the tourism experience whenever tourist visits a heritage sites such as The Great Wall of China studied using smart phone app. Memorability of tourism experiences (MTE) of respondent were examined using one-group pre–post quasi-experimental design ($n=$ 275) and compared with users with and without experiencing AR. The results stated that the AR enhance the memorability of tourism experiences of heritage tourism experience. There is a difference found in experience intensity across the MTE parameters. This research investigated the impact of AR in Memorability of tourism experiences on the satisfaction and dissatisfaction of tourists visiting heritage sites, this method also helps to address the relationship between tourist attitude to AR experience and behaviour intentions towards the memorability of tourism experiences. It gives insights to the ongoing applications and progression of AR technology in getting real life experience in tourism. [23]

Lu et al., 2022, This study analysed the acceptability in using virtual tourism during pandemic in China and the factors influencing it and the effect of virtual tourism in recovering tourism industry during and after pandemic. The effect is stated using the mixed method of quantitative (N=1288) and qualitative interviews (N=30). The use of AR in tourism cab be partly explained by the theory panned behaviour. AR can be used as an effective marketing tool to promote the tourist places and platform for sell and marketing the souvenirs and other products also has a strong effect on people's onsite destination choices. Without being actually at the destinations one can get the immersive and real-life experience using virtual tourism tool and can stick to the pandemic rules at the same time. It has been seen that people are interested in using the virtual tourism tool for different purposes even though there is no pandemic situation. As per the quantitative data obtained, virtual tourism tool is effective for the person specially for the elderly having limited mobility and the disabled. Virtual tourism also can promote sustainable tourism by reducing unwanted greenhouse gas emissions from transportation. In this study four different Socio-demographic variable were selected as

respondent such as gender, age, education, and monthly income with 1288 sample size. Then separate response was collected from gender such as male and female, for different age group such as below 19, 19-30, 31-40,41-50, 51-60 and above 60 having different monthly income such as below 2000 yuan, between 2000-5000, 5001-10000, 10001-20000, 20001-30000, above 30000 having different education level starting from middle high school up to PhD. [24]

This study was conducted to study the influencing factors on determining the acceptance of AR and VR applications in the tourism education during current pandemic using the theoretical technology acceptance model (TAM). The response of 604 Chinese university students were investigated using PLS-SEM method. Five hypothesis such as perceived usefulness, perceived end of use, hedonic motivation and perceived prise value and attitudes and behaviour intentions which dependant and non-dependant variables respectively were tested to define the use of AR/VR applications in improving effectiveness of learning. Personal ease of use will help to define a usage of technology that person believes is easy and can use without many efforts. The user's desirability of employing a specific knowledge (ATT). To measure the persons willingness to use the technology behaviour intention hypothesis were used. The results shows that 4 out 5 hypotheses were supporting the findings. The findings are implying that students will use the AR/VR application for their learning purpose only when students believes that the AR/VR application is useful for then and enhance their learning quality and performance. [25]

This study has examined the augmented reality application for exploring Florence for the UNESCO world heritage sites of Italy. The study has explored two parameters such as managerial perspective for establishing heritage sites by analysing practical and methodological challenges in implementing AR applications and the use of AR application in tourism management using hidden Florence augmented reality app for visitors in Florence. The purpose of the application was to make users aware of city's cultural heritage sites through digitisation. The data from three channels such as world press blog, YouTube sites and the data collected from Hidden Florence app through its two contribution platforms, iTunes and Google play were investigated. The results shows that there is potential in such virtual applications in providing useful data for management such as to disperse visitation, enhance connectivity to off centre attractions and manage visitors flow away from most congested sites. [26].

The author has developed a meta-analytic framework for conducting sixty-five independent studies retrieved from fifty-six papers where sampling number is N=16559 for featuring 24 constructs. It is found that AR/VR applications in tourism has varying effect on tourism experience, either directly and indirectly, through psychological response and mediators of value perception. Social interaction and simulation type positively diminished the effects of the presence on tourism experience, but prior visitation was having a negative moderating effect. The results are going to use in development of AR/VR in tourism. [27]

This study focuses on determining the tourist motivational factors to adopt augmented reality applications for tourism sites and helps to investigate the relationships between motivations and travellers' behavioural. The study model is based on two theories, Cognitive evaluation, and self-presentation theory. The survey of 473 tourist were collected through online self-administered survey using partial least square for analysis to developed a conceptual framework to determine the travellers preference to use AR applications at tourist places. Two groups were formed such as high innovative and low innovative groups for examining the effect of person's innovativeness. The results reveal that hedonic and utilitarian motivations influenced tourist attitudes towards AR applications at tourist sites. The attitude of highly innovative travel or groups towards AR applications has a significantly positive impact. [28]

The Augmented reality enables users to interact with real life environment and gives real life experience and possibly enhance the tourist experience. In this review author has investigated the current status of AR in tourism for which author have chosen a five established and emerging research clusters among this the specifically chosen a cluster that emphasise on user acceptance of augmented reality with

technology acceptance model. The current status of AR was analysed through bibliometric analysis, concept mapping and meta-analysis which helps to find a contribution of AR in the development of AR tourism. Through current research progress and findings from review the author suggested future research areas in AR tourism: there is need to extend the understanding of the Gamification, there is need to develop a different methods to capture actual behaviour of user besides of exploring behaviour intentions, there is need to measure the influence of AR on user satisfaction and other relationship by expanding meta-analysis with more empirical research, there is need to consider negative consequences of AR applications in tourism, also there is need to explore factors that influence of AR on users behaviour intentions. [29]

This articles explore the cultural differences and its effect on AR acceptance in cultural heritage tourism sites using the roles of aesthetic and hedonistic features of AR applications for heritage tourism sites. PLS Graph 3.0 were used to analyse the data collected in the form of questionnaires from 264 respondents from the cultural heritage tourism sites such as Deoksugung palace in South Korea and the An Post Museum in Republic of Ireland. Data were collected from 264 respondents from Deoksugung Palace in South Korea and the A Post Museum in Ireland were two applications having similar functionalities in terms of structure, design and interface which provides the users the historic information as well as enjoyment while handling the apps. A visitors received information brochure explaining AR in general and handling of AR apps in the sites which helps visitors to familiarize themselves with the app so they can evaluate the application more accurately. The finding stated that AR has the strongest impact on perceived usefulness and ease of use on behavioural intentions to use AR was stronger in South Korea than in Ireland. [30]

In this application, the author gave an overview of AR's mobile tour guide system. Here, the AR and Mobile guide systems provide a mobile tour guide system to avoid current problems in tour guide applications. Which will be more interactive, informative, and user-specific. [31]

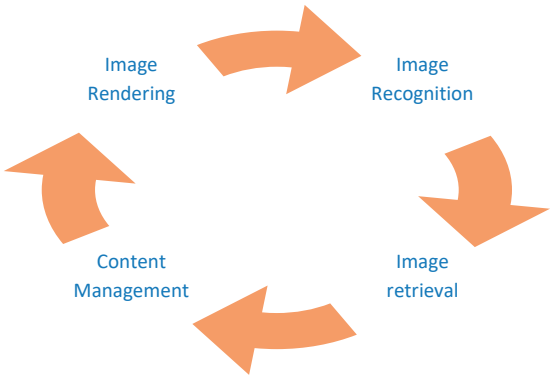

Figure 6: Mobile tour guide system architecture [31].

This paper has examined the users requirements for the development of a wearable smart glasses for AR applications in museums and art galleries. Twenty-eight visitors were analysed by conducting interview of art gallery visitors using affinity diagram techniques. The design and technical problems need to be overcome for successful use of AR in enhancing the user experience of art gallery and museum. In this study, the key content required for wearable smart glasses AR applications in museum and art gallery were analysed using four different categories such as content quality, information accessibility, links to other paintings, and personalised information which will be useful in enhancing the user experience of art gallery and museum. The requirements of content quality varies as per the user however, many participants had agreed that the wearable AR application provide more information than the information provided by the art gallery. The user response is varied for the category of information accessibility hence overall finding is that accessing information on the wearable AR application is very easier than reading displayed information, when galleries are crowded. The provision of bookmarking and image save facility must be provided to the wearable AR for later use specially for popular paintings. The links to other painting and the recommendation for the images received to visit next paintings/artwork will be helpful according to the survey conducted for werable AR applications under the category of links to the other paintings. Suggestions for the tailored and personalised tours received from some of the respondent under the category of personalised information. Functions requirement in wereable AR application were expored using

the survey conducted with respondent in the following context such as social function, navigation, ease of use and instructions for interaction with hardware and software. [32]

3.7 AR in Manufacturing Industries

The paper has demonstrated the uses of AR for problem solving in industry 4.0 by integrating virtual and real-world objects which can provide understanding of the task and context. The author has used a user centered approach with partners from the industry sector using participayory design and domain experts focus group in order to understand the solutions provided by AR to support their collaborative efforts. Real artifacts in the form of storybords are used to create a shared understanding with target users in remote collaboration. The case study on a maintene context were examined and presented the interesting insights of AR that can be applied to other remote sensing for making industry sector digitised. [33]

Digital technological progress explodes productivity in the industry. Technological progress in the manufacturing Industry leads to Industrial Revolution. This technological forward motion is Industry 4.0; it connects machinery, sensors, actuators, Information Technology, and AR. AR can be used to provide training on working heavy machinery to the workers. AR will give workers an immersive, live realistic experience of the working environment of tools inside the machines. Many researchers are working on providing virtual assistance to the maintenance for achieving accuracy. [34].

4. Methodology

The motivation of the review is to showcase research avenues in the Education field with the use of AR. AR has great potential in giving education to the students in an effective and immersive way with real-life experience.

Table 1 Analysis was done on research avenues in the use of AR in Education.

Sr. No.	Ref.	Targeted Field of Education	Purpose of AR use	Methodology
1	6	Science Education	To understand science learning with the help of AR	Image-based AR location
2	10	Medical Education	To analyse the cost of simulation-based education	PRISMA Standard
3	2	Medical Education	To identify the anatomical structure and tissue of Human body	3D Segmented visualization by Vuforia
4	34	Manufacturing Education	To demonstrate use of AR in Industry 4.0	Database 3 D environment with AR Glasses

Table 2 AR in different fields

Sr. No.	Ref	Application	Methodology	Challenges
1	31	Tourism	1.Image recognition followed by 2. Image retrieval from digital image database 3. Storing and organizing files using content management method 4. Image rendering	hard to provide latest information as information needs to update frequently
2	22	Advertising	AR system developed for the brand promotion. Readers of magazine divided into three groups. For 1st group, no AR is used, whereas the other two groups introduced with AR system low level and high level, respectively	In this article printed magazine advertisements were focused the effect may be different for advertisements displayed on television or on banners
3	18	Maintenance	1. Diagnosis of the fault using sensors and validation further with a technician data. The validated information use for further processing of repairing work using 3d animation. Gestures track while repairing stored for further analysis.	---
4	3,38	Medical	Use for medical practicians and surgeons for training and simulation of neurosurgery images from MR or CT scan used for superimposing Augmented images on the real scene.	Image registration accuracy and alignment

Table 3: AR in education for disabled person

Sr. No.	Ref.	Disability	Methodology	Results	Challenges
1	39	Cognitive disability	Vegetable entities matching task given to the user. Their behaviour and performance is investigated in decisionmaking	by 2D and 3D visualization of plant entities help children olfactory and visual and auditory clues	----
2	40	Development disability	Tangram Chinese puzzle-based learning	Special needs children were benefitted by AR making teaching and learning process more interesting	students with low comprehensive ability needs more time to complete the task
3	41	motor disability	AR based system is developed for wheelchair Persons having motor disability. Handheld device pointed towards analysis the item placed in super- market shelfs detects the product and matches with databased generated using RFID system with the help of AR SDK application	The proposed AR method for shopping is satisfactory as per the Likert based analysis	Use of tablet to seek the product is difficult
4	42	Intellectual disability	user interacts with real world through gamification Captured image through web cam from real world of Processed and display on screen	The proposed gamification method is useful for students having intellectual disabilities through interaction between students and object. This method improves active participation and curiosity	students may have difficulty with acquisition and demonstration of Concepts
5	43	Muscular dystrophy Cerebral palsy Arthrogryposis	high-quality videos captured by web cam installed in head mounted device which superimposes virtual images on real world	This method is well suited for disabled students to increase their self-esteem according to physiologist and researchers	Discomforts found in users

5. Conclusion

Even though AR has many advantages in various fields including Tourism, advertisement, education, medical science, maintenance and manufacturing still many challenges are faced in developing AR in various fields, according to the literature survey carried out on tourism many challenges can be seen but most crucial is providing the latest information on mobile based app as the data required to be updated frequently. AR is catching attention in advertising industry as it can be used for brand promotion for creating escapism effect on consumer to enhance the AR effect in brand advertising. Advertisement effect on consumer may be different for all kinds of media used for advertisement. The effect may be different for advertisement displayed on television on or banners. The purchase intention in online stores affected by the shopping experience shared by users with theire social community because there is correlation between the augmented reality ad satisfaction to the shopping enjoyment and shared social experience. The images obtained from CT scan and MR can be used to augment the images on the real scene for simulation used for training the medical practiciners. But the problem arises when the Image registration accuracy and alignment is improper. According to the literature survey in reference to the disabled persons many challenges has been seen such as discomforts, product seeking difficulty, concept acquisition and demonstration difficulty etc. which can be reduced by providing easier task for students having development disability, providing more detailed information in the app about the product which will help to seek the product easily by the user having motor disability.

The review done on Augmented Reality in Education has many Research Avenues, including printing technology education. In education system, AR application will enhance the learning experience. AR has the potential to grow exponentially in the Education field. Medical Education, Science Education, Manufacturing Industry, Printing industry are some research avenues focused on future refinement. This leads

to the attraction of researchers towards AR. Content creation is one of the key aspects of AR in medical education; rendering virtual objects is a time-consuming process, which can be an attraction for researchers to work on it to identify solutions on dynamic content creation with the time factor. More research can be carried out on the learning experience of the students.

There is potential for future research to take extended views of AR apps in printing education system. Printing machineries are very costly and require huge investment. Besides it, printing machinery also requires a lot of raw materials. Due to the machine's high speed and other parameters, a massive amount of raw material gets wasted for proper registration and eventually getting quality approved copies. AR can help the student understand the concept without wasting costly raw materials required in the technical education of the printing field. So, it is necessary to give students a real-life experience without using costly raw materials.

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