ISSN No:-2456-2165

A Comprehensive Study on Augmented Reality in Path Finding

S. SIVA NANTHINI
Studied Master of Science in Mathematics (2018 – 2020)
Working as a Freelance Researcher, Software Developer & Content Developer, Thoothukudi, India

S. ANITHA
Studying Master of Science in Physics at
M. V. Muthiah Government Arts College For Women, Dindigul, India

Abstract:- This article seeks to give a thorough overview of augmented reality's definition, uses, and deployments. In today's study domains, it is one of the most popular themes. Here, the fundamental applications and definitions are covered. This research aids in gaining a foundational understanding of augmented reality. Here, an overview of additional similar applications is covered. But even though augmented reality (AR) innovation is used in numerous industries and fields of knowledge, including games and leisure pursuits, its virtual lineage applications are still quite limited after researching the potential of utilizing current augmented reality technology. In order to maximize the overall advantages of adopting AR, this article suggests including navigation and educational components within the main AR application.

I. INTRODUCTION

Any system that mixes real and virtual information is considered to be an augmented reality system (AR). With augmented reality (AR), users can view the real environment with virtual things superimposed or blended in with it. Medical, manufacturing, visualization, route planning, amusement, and the defense are just a few of the many potential application areas for augmented reality. Recently, augmented reality (AR) applications have become incredibly common on portable devices with motion and position sensors.

Location-based services (LBS), which are utilized with smartphones and other mobile devices, are actually a key factor in the popular acceptance of augmented reality. The industry for augmented reality (AR) must clearly expand for there to be further research to concur on benchmarks, statuses suitable for augmented reality, and for there to be conversation between many AR experts on several different development levels. This is evident from the commonly accessible standards and the innumerable potential applications. Although raising current standards will be very helpful in achieving the community's long-term goals. New ideas and developing techniques must also be able to be included [1].

II. AUGMENTED REALITY

In order to provide viewers with more information, augmented reality (AR) tries to overlay virtual data on the real world. Computer-generated imagery (CGI) is combined with real images in augmented reality (AR). Following the release of Google ARCore for Android and Apple's AR kit for IOS, augmented reality (AR) on smartphones have already attracted a lot of attention. Additionally, the Vuforia AR toolset is already directly connected with the Unity game engines, aiding in the acceleration of technology adoption. When using AR on a smart phone, live footage from a camera is combined with CGI [2].

- *Latest Innovations in AR*

Wearable AR devices, like Microsoft's Hololens and Magic Leap that project computer visuals directly into the field of vision are the newest developments in augmented reality. AR headsets blend real-world light waves with CGI, similar to transparent sunglasses. Assuring that the CGI is continuously matched with and projected onto the entities in the real space as well as removing delay while moving about is difficulty for AR. While augmented reality (AR) aims to immerse the user in their immediate environments, virtual reality is completely immersive. In AR, someone can discover a log cabin lying in the palm as users open their hand [3].

- *Advantages of Using AR*

Among the most intriguing developments in the area of games or user interfaces for applications is augmented reality. The ability to alter the reality image captured by the camera found in every smartphone also created new opportunities in other fields that make use of smartphones, tablets, or other devices with additional sensors. In order to boost the quality, amount, and variety of data gathered from the surroundings, which would be the natural environment, connectivity between such sensors is very crucial [4].

By analyzing, for instance, the pulse and its interpretation, communication among diverse technical devices, such as a smartwatch and smartphone, makes it possible to assess the user's health. The ability to use the camera allows for speedy processing and analysis of the image. The results of its action can be given to the customers in a clear and understandable manner. The increased comfort and control of daily lives are indicated by the adoption of modern technologies. By using updated artificial intelligence

techniques to locate certain items and show the user the information that has been collected [5].

This kind of method can be applied in a variety of contexts, such as the home, where even the camera will detect items in the fridge and show potential recipe pairings. Based on the discovered objects, other possibility is to alert the customer to a potential life-threatening scenario. The system should also allow for voice activation in order to expand the possibilities of the interaction that is provided to the user [6]. A mathematical model analyzing image and speech samples similarly is presented in the paper. Some sample features are obtained during the procedure, and these features can be utilized to produce information input for neural classifiers [7].

III. RELATED APPLICATIONS

The uses of augmented reality in many fields are listed below.

- *Indoor Navigation*

The creation of a straightforward location-based AR technology has been a primary area of attention in indoor navigation. Different methodologies have been used to develop tracking and positioning technology. With the aid of a head-mounted display (HMD) and pointer, a mobile AR system was created to lead a user through an unknown environment. Facility maintenance trials using marker detection have shown its viability and promise. GPS, which is frequently used in outdoors AR location tracking, can also be integrated with AR [8].

However, because to poor signal penetrating its major downside is because it has a meager capacity for indoor location. Additionally, Wi-Fi technology has been used. Signals are often incredibly loud, though, and the materials and construction structures in the immediate vicinity greatly affect the signal's intensity. This can be labor-intensive and requires proper device configuration for radio frequency identification (RFID). As opposed to the use of a regular map, analysis has shown that the AR navigation technology is far better and has a great deal of potential. In a variety of industries, including production, recreation, consumer development, training, training, object recognition, location-based connectivity, aircraft positioning and pilot aid, military aircraft guidance, and others, augmented reality is used [9, 10].

- *3D Graph Visualization*

An important kind of visualization for immersed analysis is 3D Node-link diagrams. However, there is limited knowledge about edge visualization that would enable effective analysis. An examination of the edge style design space is done, and the findings of a user survey contrasting 6 major edge variations are discussed [11, 12]. With the use of augmented reality (AR), it is possible to have 3D, stereoscopic experiences that are both immersive and maintain contact with the outside world and other people. As a result, it offers great potential for expert cooperation while fusing virtual and actual worlds [13].

The need to display relationships between both actual things and virtual components of the AR environment will grow with new, complicated AR systems for the use of cases like maintenance help or machine - to - machine production lines. Computer networks that are incorporated into the surroundings flow of information in a home automation, and many other are instances of such relations. These are typically shown as 3D node-link graphs[14, 15].

There are other areas where graph data, such as flight trajectories, can be examined in three dimensions without necessarily being related to actual objects. These areas could still gain from augmented reality in relation to the physical mobility, appearance, and natural connection. These illustrations demonstrate the significance of 3D graph representations as a type of visualizations in immersive analytics. Nevertheless, there hasn't been much exploration on how to effectively and efficiently analyze 3D graphs in augmented reality [16].

- *Augmented Reality in Vehicles*

Carpooling is likely to change how people move around drivers may need to become used to increased connectivity and altered automobile features. For instance, our commute times are getting longer and longer. It is consequently difficult to create a user interface that is simple to use and swiftly performs all important tasks, such as those required by commuters. All of these needs may be met with the usage of AR technology [17]. Researchers and automakers discuss ideas for using augmented reality to create unique in-car interfaces, such augmented controls that float in the air. Inside of automobiles, 3D AR apps enable transferrable, customizable, and context-specific information interfaces [18]. Different angles can be used to manipulate floating 3D objects. HMDs head-mounted displays that show augmented reality (AR) items and allow for human input are extremely likely to get smaller and eventually resemble contact lenses in size. Modern AR HMDs' great mobility and integrated natural input options, such speech and gesture, are particularly advantageous. It can be used in many applications like extended vision to see through vehicles, behavioural detection of driver using AR, identifying parking spaces etc [19].

- *AR in Education Environment*

AR systems combine the real and virtual worlds at the same time and place virtual things in actual environments. The use of augmented reality (AR) in education offers advantages through the accumulation of information and experiences that may be abstract, challenging to comprehend, challenging to see, and even dangerous in a classroom setting. AR is a useful educational tool with a lot of potential for future learning, particularly in the area of the growth of creative abilities [20].

Through interacting with things from virtual settings, augmented reality (AR) has been acknowledged as a tool that can assist students in achieving real-world objectives. Applications of augmented reality (AR) in education claim to have a range of academic advantages, such as boosting student engagement in the course, delivering an efficient and

effective learning environment, and evoking good emotional reactions. Additionally, through an unforgettable experience brought on by engaging activities, augmented reality (AR) enables pupils to experience flow and aids in developing a more full attention. The use of augmented reality (AR) technology may be crucial in enhancing the flow and immersion experiences [21, 22].

- *AR in Healthcare*

Applications for medical topics of healthcare education now use virtual augmentation and assistance of AR and MR more frequently. The number of research studies examining the use of AR in orthopedics is rapidly growing. In delicate industries like medical and healthcare, program accessibility is crucial and forms the basis of user-centered design methodologies. AR is a practical way to enhance the communication and processing of data during operation [23].

The utilization of visual data, such as pre- and intra - operative obtained medical pictures, as well as numerical and geometrical information is common in orthopedic surgery. Furthermore, accurate alignment of the entry spots in respect to the patient's physiology is necessary for standard mechanical orthopedic treatments [24]. These treatments include the installation of screws, cables, implantation, and the rectification of abnormalities. Due to the intuitive addition of medical data, AR applications appear to be especially helpful in aiding surgeons during exact and scheduled surgical procedures and improving their skills [25].

- *Sunmap System Case*

The SunMap+ app for Android smartphones may help people find their way to their objectives in enclosed spaces. Through an AR interface, the device serves as a virtual local guide and shows a 3D floor plan and design of the Sunway University campus [26]. The image recognition approach is used to initialize and recognize areas on the Sunway campus in order to determine the user's present position on the 3D map. The PDR system is considered as an addition to the image recognition implementing this technology. It is used by SunMap+ to keep monitoring the user's movements after the user's initial spot has been established using visual recognition. Including the 3D floor plans, there are also offered navigation trails to help users get to their desired locations [27].

IV. FUTURE APPLICATIONS

Upcoming Immersion Analytics scenarios will heavily rely on 3D graph visualizations in AR, whether for the depiction of information in a 3D strategy execution or for large datasets linked to actual material things and places, depicting links, interconnections, and hierarchies. Exploration on the fundamental issues about how to style lines and nodes and how to express qualities with graphic elements in such environments is lacking. It demonstrates the viability of shape- or geometry-based methods for edge versions in AR networks and enables designers to select methods in accordance with their requirements [28].

Researchers plan to investigate multidimensional data codes on graph vertices and nodes in the future according to the design space. Researchers also intend to take a close look at some specific uses, such the networking and data flow analysis in cyber-physical production technologies or other intelligent contexts [29]. Real-world factors including occlusion by and by physical things as well as alignment to material things will be important there. Although technology is capable of change, [30] it will require the assistance of new technologies. Examples include 5G, which will enable lightweight as well as intelligent equipment, or AR cloud, which can assist in computing the most complicated ideas. Only cloud technologies are related to the field of augmented reality however other innovations, such artificial intelligence frameworks or biosensors, also are appropriate for integration with AR and VR applications. Furthermore, strong hardware systems are required for AR applications. Therefore, it would be expected that the cloud computing technology would be the first of all of them just to integrate with AR.

Only a few studies specifically address the development of collaborative settings. One of the factors why collaborative environments have not advanced is because there are almost no standardized techniques to represent and transmit messages from the virtual environment. Future research that focuses on creating standards in this manner may enable the integration of devices from many manufacturers and encodings into unified virtual environment [31].

V. CONCLUSION

This study discovered that augmented reality affects the researcher's intentional concentration. Additionally, it is believed that the ability to sense objects that don't truly exist with AR technology helps to draw in more viewers. The perception of presence is increased by employing AR in science teaching. A significant advancement in the field of advanced research has been driven by AR. since the research field is constantly evolving. And the usage of AR is still being developed for many applications, improving their effectiveness. Their characteristics and uses are being improved through a variety of techniques and methods of synthesis. Due to the numerous uses of AR, from interior to outdoor settings, they are commonly employed. They therefore attracted a lot of attention from the fields of study and technological advancement. AR will undoubtedly be a great success in the future in terms of upgrading the civilization.

REFERENCES

[1]. Albaqami, N, N., Allehaibi, K, H. & Basori, A, H. (2018). Augmenting pilgrim experience and safety with geo-location way finding and mobile augmented reality. *International Journal of Computer Science and Network Security*, 18 (2), pp. 23-32.

[2]. Buschel, W., Vogt, S. & Dachselt, R. (2019). Augmented reality graph visualizations. *IEEE computer graphics and applications*, 39(3), pp. 29-40.

[3]. Chang, H., Liang, J. & Tsai, C. (2020). Students' context-specific epistemic justifications, prior knowledge, engagement, and socioscientific reasoning in a mobile augmented reality learning environment. *Journal of Science Education and Technology*, 29(3), pp. 399-408.

[4]. Younis, O., Al-Nuaimy, W. & Rowe, F. (2019). A hazard detection and tracking system for people with peripheral vision loss using smart glasses and augmented reality. *International Journal of Advanced Computer Science and Applications*, 10 (2), pp. 24-150.

[5]. Diao, P. & Shih, N. (2018). MARINS: A mobile smartphone AR system for pathfinding in a dark environment. *Sensors*, 18 (10), pp. 34-142.

[6]. Wiegand, G., Mai, C., Hollander, K. & Hussmann, H. (2019). Incarar: A design space towards 3d augmented reality applications in vehicles. *Proceedings of the 11th international conference on automotive user interfaces and interactive vehicular applications*, 3(2), pp. 100-133.

[7]. Diaz-Vilarino, L., Boguslawski, P., Khoshelham, K. & Henrique Lorenzo, H. (2019). Obstacle-aware indoor pathfinding using point clouds. *ISPRS International Journal of Geo-Information*, 8 (5), pp. 23-103.

[8]. Gerup, J., Soerensen, C, B. & Dieckmann, P. (2020). Augmented reality and mixed reality for healthcare education beyond surgery: an integrative review. *International journal of medical education*, 11(2), pp. 25-100.

[9]. Hernandez, J, D., Sobti, S., Sciola, A., Moll, M. & Kavraki, L, E. (2020). Increasing robot autonomy via motion planning and an augmented reality interface. *IEEE Robotics and Automation Letters*, 5 (2), pp. 1017-1023.

[10]. Varun, C. H. and Karthikeyan, J., 2020, RFID-GPS based mechanism using aodvrp for stolen vehicle detection in VANET, *Indonesian Journal of Electrical Engineering and Computer Science*, 18(1), 396-404.

[11]. Guhl, J., Hugle, J. & Kruger, J. (2018). Enabling human-robot-interaction via virtual and augmented reality in distributed control systems. *Procedia CIRP*, 76(2), pp. 167-170.

[12]. Hesenius, M., Borsting, I., Meyer, O. & Gruhn, V. (2018). Don't panic! Guiding pedestrians in autonomous traffic with augmented reality. *Proceedings of the 20th International Conference on Human-Computer Interaction with Mobile Devices and Services Adjunct*, 2(1), pp. 261-268.

[13]. Innocente, C., Ulrich, L., Moos, S. & Vezzetti, E. (2022). Augmented Reality: Mapping Methods and Tools for Enhancing the Human Role in Healthcare HMI. *Applied Sciences*, 12 (9), pp. 42-195.

[14]. Sudhaman, P., Surendiren, P., Meeran, S. S. and Kishore P. C., "Augmented reality in automation using virtual 3D models,"*Third International Conference on Computing, Communication and Networking Technologies (ICCCNT'12)*, 2012, pp. 1-4.

[15]. Tang, J. K. T., Duong, T. Y. A., Ng, Y. W. and Luk,H. K. "Learning to create 3D models via an augmented reality smartphone interface,"*IEEE International Conference on Teaching, Assessment, and Learning for Engineering (TALE)*, 2015, pp. 236-241.

[16]. Weng,T. H., FischerR. and Fu,L. C. "3D Scene Reconstruction from RGB Images Using Dynamic Graph Convolution for Augmented Reality,"*IEEE Conference on Virtual Reality and 3D User Interfaces Abstracts and Workshops (VRW)*, 2022, pp. 638-639.

[17]. Ferreira, M., Gomes,P., Silvéria, M. K. and Vieira,F. "Augmented Reality driving supported by Vehicular Ad Hoc Networking,"*IEEE International Symposium on Mixed and Augmented Reality (ISMAR)*, 2013, pp. 253-254.

[18]. Varun, C. H. and Karthikeyan, J., 2017. Recent survey on traffic optimization in intelligent transportation system,*Journal of AdvancedResearch and Dynamic Control Systems*, 9(15), 89-100.

[19]. Varun, C. H. and Karthikeyan, J., "Design and Implementation of Parking System Using Feature Extraction and Pattern Recognition Technique"*Intelligence in Big Data Technologies—Beyond the Hype*, Springer, 2020, pp. 389-400.

[20]. Subakti, H., Tolle, H. & Aswin, M. (2018). Engfi Gate: An Indoor Guidance System using Marker-based Cyber-Physical Augmented-Reality. *International Journal of Electrical & Computer Engineering*, 8 (1), pp. 88-108.

[21]. Martin, J., Bohuslava,J. and Igor, H., "Augmented Reality in Education 4.0,"*IEEE 13th International Scientific and Technical Conference on Computer Sciences and Information Technologies (CSIT)*, 2018, pp. 231-236.

[22]. Bazavan, L. C., Roibu,H., Petcu,F. B., Cismaru, S. I. and George,B. N.,"Virtual Reality and Augmented Reality in Education,"*30th Annual Conference of the European Association for Education in Electrical and Information Engineering (EAEEIE)*, 2021, pp. 1-4.

[23]. Syahry, A., Basuki, D., Sukaridhoto,S., Budiarti, N., Hanifati, K. and Muntahir, I., "Implementation of Augmented Reality in Medical Education," *International Electronics Symposium (IES)*, 2022, pp. 684-690.

[24]. Kleinbeck, C., Schieber, H., Andress, S., Krautz C. and Roth, D., "ARTFM: Augmented Reality Visualization of Tool Functionality Manuals in Operating Rooms,"*IEEE Conference on Virtual Reality and 3D User Interfaces Abstracts and Workshops (VRW)*, 2022, pp. 736-737.

[25]. Kim, J., Agarwal, S., Marotta, K., Li, S., Leo, J. & Chau, D, H. (2019). Mixed reality for learning programming. *Proceedings of the 18th ACM International Conference on Interaction Design and Children*, 2(1), pp. 574-579.

[26]. Salar, R., Arici, F., Caliklar, S. & Yilmaz, R, M. (2020). A model for augmented reality immersion experiences of university students studying in science education. *Journal of Science Education and Technology*, 29(2), pp. 257-271.

[27]. Lanham, M. (2018). *Learn ARCore-Fundamentals of Google ARCore: Learn to build augmented reality apps for Android, Unity, and the web with Google ARCore 1.0.* Packt Publishing Ltd.
[28]. Li, H., Gupta, A., Zhang, J. & Flor, N. (2020). Who will use augmented reality, an integrated approach based on text analytics and field survey. *European Journal of Operational Research*, 281(3), pp. 502-516.
[29]. Quintero, C, P., Li, S., Pan, M, K, X, J., Chan, W, P., Loos, H, F, V, D. & Croft, E. (2018). Robot programming through augmented trajectories in augmented reality. *2018 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2(1), pp. 1838-1844.
[30]. Nikhashemi, S, R., Knight, H, H., Nusair, K. & Liat, C, B. (2021). Augmented reality in smart retailing: A (n)(A) Symmetric Approach to continuous intention to use retail brands' mobile AR apps. *Journal of Retailing and Consumer Services*, 60(2), pp. 102-464.
[31]. Polap, D. (2018). Human-machine interaction in intelligent technologies using the augmented reality. *Information Technology and Control*, 47 (4), pp. 691-703.