IOSR Journal of Engineering (IOSRJEN) **www.iosrjen.org**
ISSN (e): 2250-3021, ISSN (p): 2278-8719
Volume 13, PP 39-42

Study of Augmented Reality Navigation Systems

Abhishek Jain[1], Shreyas Sawant[2], Abhishek Jha[3], Prof. Suvarna Pansambal[4]
[1,2,3,4] *(Computer Engineering, Atharva College Of Engineering Mumbai, India)*
Ajj.2396@Gmail.Com[1],Shreyassawant018@Gmail.Com[2],Ajha025@Gmail.Com[3],Suvarnashirke@Atharvacoe.Ac.In[4]

***Abstract*:** *Reanimating virtual objects into real world is what strives the Augmented Reality community. By virtue of AR, the user gets to firsthand experience a virtual object which seems to exist in the real world environment, but is paradoxical as the object is just a mere representation. Augmented Reality Techniques are revised and extended from their legacy counterparts leading to betterment of the existing solutions. These researches have birthed into ideas which earlier were unheard of, Point-Clouds, SLAM, Kalman Filter are to name a few. Almost every smartphone today has the hardware and software capability to process AR on-board, along with this the devices are designed with various sensors, GPS being one of them. The Global Positioning System (GPS) is the leading technology to determine locations on mobile devices. However, traditional Navigation Systems are monotonous and less reciprocative when it comes to User Experience, which can be eliminated with the introduction of AR. This paper is a study of existing systems which implement Navigation using Augmented Reality thus giving an immersive window for UX.*

Keywords: *Augmented Reality, Navigation System, GPS, SLAM*

I. Introduction

Augmented Reality gained popularity, and momentum with the technology advancement in the 21st century as the devices were designed to be capable enough to process the information on board. As per Definition, Augmented Reality is an area of research that aims to enhance the real world by overlaying computer-generated data on top of it. This broad spectrum of Augmented Reality led to introduction of various techniques and algorithms to achieve the goal.

The main aim of Augmented Reality was to achieve accurate registration and tracking of virtually overlapped objects on the real world environment. Over the Years, researchers have developed and implemented various ways & techniques to achieve accuracy. This list of various techniques is never ending, and some of the most well-known and stable algorithms are SLAM, Kalman Filter, 3D Point cloud mapping. Each of these techniques focus on some or the other aspect of the environment to maintain stability and accuracy over parameters guiding the output of AR. Even after years of research no single technique has been proved to be producing the promising output single-handedly. There have been made approaches to combine two or more techniques to achieve the goal.

The Characteristics of Good Augmented Reality objects are good texture, reduced virtual artifacts and saliency of video background, in both known and unknown environment. Applications being developed often fail to perform in an unknown environment, limiting the applications performance to a known environment. Hence, there was a need to develop techniques to be able to reconstruct the virtual objects on runtime. One of the promising techniques is SLAM. It refers to set of ways for pose-estimation, providing with the ability to register the environment on runtime, providing the ability to better understand the unknown environment.

Apart from these technical specification of AR, it is an enhancement which can provide detailed information by overlaying it on the real world wherever found helpful. This has proven to be the strength of AR, making it a feasible solution for various problems and applications.

AR is known for its open paradigm toward innovation, and one of the primary fields where AR can be applied is Navigation. Navigation system just like similar to AR, asks for involve intensive User-interaction which is the crucial segment of the functional segment of the whole system. The idea of combining traditional Navigation systems with AR to superimpose virtual objects on user's screen, based on the surrounding environment will serve as an efficient tool along with other services available. This paper thus, is a survey of various technical advancements in AR which have been implemented to be improvised inside Navigation systems.

II. Literature survey

Conventional navigation systems require users to count exits, which is tricky and may again be ambiguous when the driver is not sure whether to additionally count a small auxiliary exit. Narzt et.al [5] relieved the user from this burden and clearly highlights the next path. ARNavi is built upon a core framework

where state-of-the-art positioning systems (primarily GPS) are used for keeping track of the car. Image recognition algorithms for tracking are not included in the framework, which economizes calculating power and enables applications to be executed on devices with lower CPU power. This system uses an external computing device for all the real time processing which makes it expensive. It was also proposed as a pedestrian navigation system where in the processing was again done using external video feed processor. The figure 1 shows the external device setup for the proposed system. In this system, an additional factor orientation was needed to locate the user device in world space for accurate augmentation.

Fig 1: External AR Navigation device setup for user [5]

In augmented reality, Simultaneous Localization and Mapping is one of the important factors that is considered while augmenting. Considering the types of environments such as indoor, outdoor, controlled environments,etc different types of SLAM are suited for them. Reitmayr et. al [1] proposed a system that provides a way for the creation of the models required for tracking as well as annotations in the same process. Building AR systems that provide accurate tracking in unknown environments promises to remove the dependency on mapped descriptors as they often require extensive and accurate models of the environments, interactive objects and virtual annotations. Efficient implementations of SLAM needs appropriate sensor models to achieve a more precise and robust outdoor localization method. SLAM basically localizes the user in the real time environment using its location and the surrounding environment. Figure 2 shows a virtual model of a building being augmented on an office desk.

Fig 2: Augmentation of an object model of a building, on an office desk [1]

Kim et. al [3] proposed a plane detection method which detects multiples planes based on the proposed constrained sampling strategy. In addition, when the multiple planes are detected, the importance for contents is measured by the score functions based on the properties of planes such as size, color, and position. This improves the precision and it speeds up the process. First, a real time multiple plane detection method with constrained sampling, which is a main procedure in RANSAC, is proposed. Second, from the detected planes, a projection area is automatically selected within each plane by handling the occlusion due to real objects. Finally, the best plane (i.e., projection area) for projecting content is automatically selected while considering the size, ratio, and color of planes.

Hou et. al [2] focused on machine vision which is generally used to detect ,track and extract the defining features of an object. It follows Automated Optical Inspection(AOI) technique which is mainly used to detect flaws in the product. In this system, a 3D representation of an object is created using multiple CCD sensors which helps in creating a better object recognition system. The image processing algorithms has the primitiveness and it can change the shape and color of the target detection.

In augmented reality systems the feed from the camera is to be processed and used to procure the important descriptors from the surrounding. Mankar et.al [4] developed a system to detect the lanes on the road along with the departure system. The concept in such systems works towards development of the lane departure warning system based on video image processing techniques for Night light, rainy weather, broken lane and normal road conditions. The lane image capturing is one of the most crucial aspect in the lane detection and lane recognition, which can provide the necessary information when the vehicle is in motion. In this system, the captured feed is processed using image processing techniques such as canny edge detection, hough transform to obtain noise free region of interest.

Considering the advancement in IOT and wearable technologies, various augmented AR wearables have been launched. Zhen et. al [8] aimed to design an optical see-through system that can provide depth images and make it more suitable for registration and tracking which also provides gesture based interaction using a headgear. It consists of three modules which are tracking module, interaction module and the renderer module. This system works in a virtual environment and hence may fail in a real environment due to varying parameters. The headgear restricts the user's gesture based movement to the camera's view which is a major drawback for this system**.**

Shea et. al [7] developed a location based augmented reality game that forces a user to roam its nearby physical surrounding by using the mobiles devices capabilities. PKG has two important modules Mobile client and Pokemon regional game server. In this system, the major updates i.e. map entities, nearby important locations, etc are processed on nearby server, and the minor updates i.e. the pokemons, and other data of only local area are the two main processes that run continuously. According to the usage statistics, the battery consumption is very high which eventually causes heating of the mobile device. This system proposes a cloud based architecture which processes every task on the cloud and uses the mobile device to just render the output. Cloud based architecture majorly relies on type of network connection and may lag in remote environments.

Narzt et.al [5] talks about geometrical positioning of virtual objects on the real world using the topological mapping. Reitmayr et. al [1] proposes a technique (SLAM) to map the topology of the real world scene. This conveys the stability for the virtual object irrespective of the orientation of the device. These two techniques when compared with each other, try to achieve the same goal but by different means. The same output can be improved by combining Mapping techniques in SLAM, which help the algorithm understand the pose inside any environment.

III. Future Scope

These implementations have shown the feasibility of the systems presented and their practical transformation is about to happen.

Navigation systems depend upon the sensors in the outdoor environments for computing. location, orientation and also the user view. These sensors can add up a lot of noise in the actual data causing errors in judgements. Better sensor adjustments according to the environment threshold parameters will result into efficient navigation systems.

For further advancements in the navigation systems, design and architectural reforms are made into the base architecture of automobiles. One of the most up-and-coming transformation may happen by using this knowledge to create autonomous driving vehicles resulting into a complete independent system. This thought leads us to an alternate system that provides us a complete natural experience without any human intervention. The recent developments in the head-up displays facilitates the usage of these as augmentation rendering displays with better controls and experience.

Until now, computer vision techniques were only employed for procuring the unique parameters but never for understanding the environment and the objects in the surrounding. Understanding the objects would help us provide relative interaction to these objects using augmentation. These interactions lead us further closer to the path of completely mixing the real and virtual world. For example, tapping on a thermometer would pop up instructions regarding its proper usage on the user display. Other promising applications such as virtual billboards help the society by reducing the waste caused by these billboards and on top of that providing user specific advertisements leading to better results.

IV. Conclusion

This paper discusses various researchers' work, and the combination of techniques they applied to implement AR in real world on run-time. These developments showed us the processing involved in achieving the set goals.

Our research puts forward techniques that would help keep the plane steady thus leaving the augmented element uncompromised. Integrating augmentation logic into navigation would ease the user from the conventional to and fro movements from phone to roads by highlighting path onto the device itself.

These early case studies provide us with the critical information which acts as a source of development on the platforms which are capable of executing the intensive processing without any external modifications or upgrades

Technology advancements paved the path for AR content to be rendered on board, similarly these advancements also list various issues which need to be overcome to improve the superimposed object's properties.

References

[1] Reitmayr, G., Langlotz, T., Wagner, D., Mulloni, A., Schall, G., Schmalstieg, D., & Pan, Q. (2010, July). Simultaneous Localization And Mapping For Augmented Reality. In *Ubiquitous Virtual Reality (Isuvr), 2010 International Symposium On* (Pp. 5-8). IEEE.

[2] Hou, Y. Y., Chiou, S. Y., & Lin, M. H. (2017, April). Real-time Detection And Tracking For Moving Objects Based On Computer Vision Method. In *Control And Robotics Engineering (Iccre), 2017 2nd International Conference On* (Pp. 213-217). IEEE.

[3] Kim, D. Chae, S. Seo, J. Yang, Y, & Han, T. D. (2017, March). Realtime Plane Detection For Projection Augmented Reality In An Unknown Environment. In *Acoustics, Speech And Signal Processing (Icassp), 2017 IEEE International Conference On* (Pp. 5985-5989). IEEE.

[4] Mankar, S. J., Demde, M., & Sharma, P. (2016, November). Design Of Computer Vision Intelligent System For Lane Detection. In *Green Engineering And Technologies (Ic-get), 2016 Online International Conference On* (Pp. 1-3). IEEE.

[5] Narzt, W. Pomberger, G., Ferscha, A., Kolb, D., Müller, R., Wieghardt, J., ... & Lindinger, C. (2006). Augmented Reality Navigation Systems. *Universal Access In The Information Society*, *4*(3), 177-187.

[6] Saxena, P. (2015). Geo-location Based Augmented Reality Application. *School Of Computing Science And Engineering, Galgotias University*.

[7] Shea, R., Fu, D., Sun, A., Cai, C., Ma, X., Fan, X., ... & Liu, J. (2017). Location-based Augmented Reality With Pervasive Smartphone Sensors: Inside And Beyond Pokemon Go!. *IEEE Access*.

[8] Zhen, L., Jing, C., Zixiang, Z., Qiushuo, T., & Ningsheng, H. (2016, September). An Optical See-through Augmented Reality System With Gesture-based Interaction. In *Virtual Reality And Visualization (Icvrv), 2016 International Conference On* (Pp. 447-452). IEEE.