

# DATA VISUALIZATION USING AUGMENTED REALITY

Vasu upadhayay<sup>1</sup>, Monisha rajeshree V<sup>2</sup>

<sup>1</sup>UG Scholar, Dept. of IT, Dept. of Information Technology, PSG College Of Technology, Tamil Nadu, India

<sup>2</sup>UG Scholars, Dept. of IT, Dept. of Information Technology, PSG College Of Technology, Tamil Nadu, India

\*\*\*

**Abstract** - Augmented Reality aims at augmenting real world objects and making it interactive. Augmented reality is the blending of interactive digital elements like dazzling visual overlays, buzzy haptic feedback, or other sensory projections into our real-world environments. It's a technology that finds uses in more serious matters, from business to warfare to medicine. This project gives a 3D view of the entire industry along with the machines on a flat surface through the camera view of the mobile. This also provides information about the machines such as running state, efficiency etc. 3D objects of machines (.obj files) and details about the machines are stored in cloud blob storage and PostgreSQL database of Microsoft Azure cloud. Then when required the 3D machine objects are rendered. If the objects are clicked then the real time status of the machines will be displayed. Data acquisition systems are fitted to the machines and connected to cloud database. The status of the machine is fetched by the data acquisition systems and updated in the cloud for a regular time interval. This application will fetch the details from the cloud for displaying it to the user.

**Key Words:** Augmented Reality, medicine, 3D view, cloud, dazzling visual

## 1. INTRODUCTION

Augmented Reality (AR) is a technique that enables users to interact with their physical environment through the overlay of digital information. AR is a field of computer science which deals with combination of reality with computer generated data that aids enhancement over a real-world environment in real time. Virtual Reality (VR) and Augmented Reality (AR) are technologies that have a wide spread reach in various technological fronts and have a very promising prospect for various diversified research avenues. An in-depth understanding of trends, challenges, future scope for AR systems is discussed in this survey paper. Authors have made a conscious effort to investigate the state of the art in AR Technologies and its diversified engineering application areas. Various aspects of the design of an AR system are taken into consideration, like interfacing devices for interacting with virtual world, software and the hardware etc. Also, a few specific applications that have been developed using the AR technology and possible avenues for future research in the field of AR are described. Latest trends & evolution of this technology have been touched upon for better understanding. Various applications have been explored and possible approaches for enhancing the use of this technology have been discussed. We have discussed some of the limitations in developing such systems. Tools

available for development of AR applications that satisfy the current requirements are included. Future directions and suggestions for effectively and efficiently improving the application areas have been focused upon.

## 1.1 AR COMPONENTS

### 1.1.2 SCENE GENERATOR

The scene generator is the device or software responsible for rendering the scene. Rendering is not currently one of the major problems in AR, because a few virtual objects need to be drawn, and they often do not necessarily have to be realistically rendered in order to serve the purposes of the application.

### 1.1.3 TRACKING SYSTEM

The tracking system is one of the most important problems on AR systems mostly because of the registration problem. The objects in the real and virtual worlds must be properly aligned with respect to each other, or the illusion that the two worlds coexist will be compromised. For the industry, many applications demand accurate registration, especially on medical systems.

### 1.1.3 DISPLAY

The technology for AR is still in development and solutions depend on design decisions. Most of the Display devices for AR are HMD (Head Mounted Display), but other solutions can be found. When combining the real and virtual world two basic choices are available: optical and video technology. Each of them has some tradeoffs depending on factors like resolution, flexibility, field-of-view, registration strategies, among others. Display technology continues to be a limiting factor in the development of AR systems. There are still no see-through displays that have sufficient brightness, resolution, field of view, and contrast to seamlessly blend a wide range of real and virtual imagery. Furthermore, many technologies that begin to approach these goals are not yet sufficiently small, lightweight, and low-cost. Nevertheless, the past few years have seen a number of advances in see-through display technology.

## 1.2 MOBILE AUGMENTED REALITY

As computers increase in power and decrease in size, new mobile, wearable, and pervasive computing applications are rapidly becoming feasible, providing people access to online resources always and everywhere. This new flexibility

makes possible new class of applications that exploit the person's surrounding context. Augmented reality presents a powerful user interface (UI) to context aware computing environments. AR systems integrate virtual information into a person's physical environment so that the person will perceive that information as existing in their surroundings. Mobile augmented reality systems provide this service without constraining the individual's whereabouts to a specially equipped area. Ideally, they work anywhere, adding a palpable layer of information to any environment whenever desired. By doing so, they hold the potential to revolutionize the way in which information is presented to people. Computer-presented material is directly integrated with the real world surrounding the freely roaming person, who can interact with it to display related information, to pose and resolve queries, and to collaborate with other people. The world becomes the user interface. Hence, mobile AR relies on AR principles in truly mobile settings that is, away from the carefully conditioned environments of research laboratories and special-purpose work areas. Quite a few technologies must be combined to make this possible they are global tracking technologies, wireless communication, location-based computing (LBC) and Location based services (LBS), and wearable computing.

### 1.3 VISUALIZATION

AR is a useful visualization technique to overlay computer graphics on the real world. AR can combine visualization method to apply to many applications. A vision-based AR system was presented for visualization interaction. A device called gyroscope was developed to support some applications such as city, landscape and architectural visualization. AR visualization aids laparoscopic surgery. AR also enables visualization of invisible concepts or events by superimposing virtual objects or information onto physical objects or environments. AR systems could support learners in visualizing abstract science concepts or unobservable phenomena, such as airflow or magnetic fields, by using virtual objects including molecules, vectors, and symbols. For example, Augmented Chemistry allowed students to select chemical elements, compose into 3D molecular models, and rotate the models. Clark et al. proposed an augmented paper-based coloring book with 3D content and provided children with a pop-up book experience of visualizing the book content. These augmented real objects create new visualizations that have potential to enhance the understanding of abstract and invisible concepts or phenomena.

### 2.1 PROPOSED SYSTEM

The solution is that the application is Augmented Reality based application. It is a cross platform (works with both Android and iOS) application. For cross platform application development react JavaScript is used with react native library and for adding AR features Viro react package is used. Then 3D objects of the machines in obj format is fed and rendered in real world scenario based on the industry

layout. Then the API connection is established for fetching real time data and displays it to the user if the user clicks the rendered machine objects.

### 2.2 CHALLENGES AND ISSUES

Despite the growing interest in AR and the large body of advances and research, several challenges and issue still exist and need to be addressed. In this section, we classify the limits that characterize the current state of the art of AR based on the following aspects: technology, social acceptance, usability. Considerable advances made in each of the areas described in this paper. However, there are still limitations with the technology that needs to be overcome. AR system has to deal with vast amount of information in reality. Therefore, the hardware used should be small, light, and easily portable and fast enough to display graphics. Also, the battery life used by these complicated AR devices is another limitation for AR's uses. Also, AR tracking needs some system hardware such as GPS to provide accurate marker, ask them to be both accurate and reliable enough. These hardware obstacles need to be resolved for practical AR use. AR systems usually obtain a lot of information, and need software to filter the information, retain useful information, discard useless data and display it in a convenient way. Another challenge is that to bring the view of entire industry within a small plane. To overcome this, we used scaling factor. The scaling factor could be derived using the length and width ratio of the entire industry to that of the length and width ratio of the plane where the machines are about to be rendered. The general derivation is given below:

$$\text{Total Length} = \text{Industry Length}$$

$$\text{Total Width} = \text{Industry Width}$$

$$\text{Layout Length} = \text{Plane Length}$$

$$\text{Layout Width} = \text{Plane Width}$$

$$\text{Scaling Factor} = \min \left( \frac{\text{Layout Length}}{\text{Total Length}}, \frac{\text{Layout Width}}{\text{Total Width}} \right)$$

$$\text{For example, if Total Length} = 300\text{m,}$$

$$\text{Total Width} = 100\text{m,}$$

$$\text{Layout Length} = 3\text{m,}$$

$$\text{Layout Width} = 1\text{m,}$$

$$\text{then scaling factor} = \min (3/300, 1/100)$$

$$\text{Scaling factor} = 0.01$$

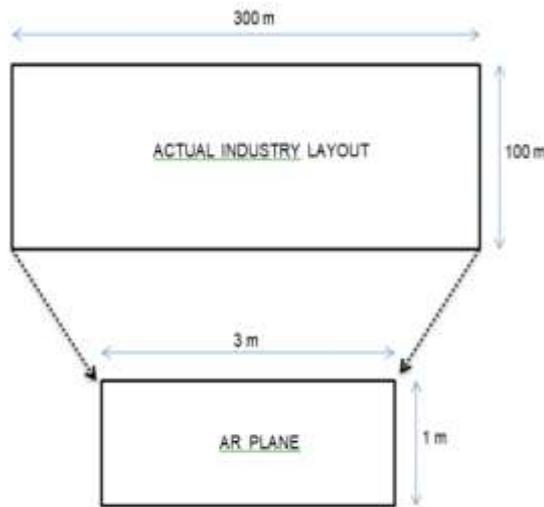


Fig -1: Scaling factor diagram

acquisition system’s software, where it is record for further review and analysis.

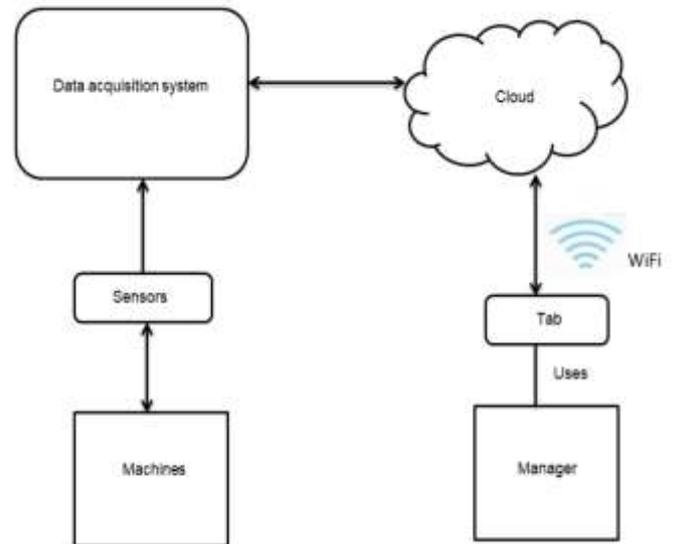


Fig -2: Data Acquisition flow diagram

### 2.3 DESIGN AND IMPLEMENTATION

As we need real time data updates here, we need modern web development tools. This application is programmed in React JavaScript and runs on Node JavaScript. This application also uses other Open-source programming libraries and tools. The application is accessible via a single API (Application programming Interface). NET OPC UA server was chosen as a communication interface to data acquisition device. It was chosen as a communication protocol between Connector and Cloud service SQL protocol to provide direct data insertion onto database tables. This application was developed with real time communication features and asynchronous functionality. React JavaScript is the interface for this application.

#### 2.3.1 DATA ACQUISITION

Data about the machines is collected using data acquisition systems. The data acquisition system is an information system that collect, stores and distributes information. It is used in industrial and commercial electronics to acquire information about the machines. A data acquisition system is also called as data logger. Data acquisition system includes different tools and technologies that are designed to accumulate data. It generally consists of its own software and hardware along with sensors and actuators and they need underlying network support for communication of data between data acquisition hardware and software. The hardware generally consists of components in the form of external expansion cards. They can be connected through a communication interface such a PCI or USB or can be directly installed onto the motherboard. The hardware is connected with the input device such as a 3D scanner or analog to digital converter. The signal from the input device is sent to the hardware device which process and sends it to the data

The Fig 5.1 depicts the whole process of fetching the real time data from the machines using data acquisition systems and cloud infrastructure to feed it to the application running in hand held devices.

#### 2.3.2 API

Application Programming Interface (API) is developed using c# that fetches the details from the PostgreSQL database hosted in azure cloud. This API is in turn used to fetch the details and feed it to front end AR UI components to display it to the user.

#### 2.3.3 REACT JS

In React, objects to render are described in the code itself (instead of telling the browser how to do it). This also means that the amount of boilerplate is greatly reduced. In React you simply start coding; it has no component boilerplate that you have to generate. There’s some setup involved, but when it comes to the components, you can express them as pure functions.

#### 2.3.4 VIRO REACT

Viro react is a developer platform for rapidly building AR/VR applications using React Native. This package provides several features in AR such as animations, interactions with AR components etc.

### 3. CONCLUSION

Thus, effective data visualization has been made through augmented reality application. Instead of visualizing the objects in the mind and seeing the data, actual digital models

of the objects have been built in the real world. This paves way for the user to get the clear picture of what the data is about and therefore could be used for effective management of machines in an industry. Machines are rendered into real world effectively and real time data is shown efficiently to the user when the user clicks the digital machine objects. Slight delay in the AR scene is felt when the screen is moved along faster. Existing systems used for data visualization are 2D based and the user might not be able to get the clear picture of what the data is about. So we conclude that the system is better than existing and works efficiently.

## REFERENCES

1. I.R. Azuma. Tracking requirements for augmented reality. *Communications of the ACM*, 36(7):50-51, 1993.
2. M. Billinghurst and H. Kato. Mixed reality - merging real and virtual worlds. *Proc. International Symposium on Mixed Reality (ISMR '99)*, 261-284, 1999.
3. A. Fuhrmann et. al. Occlusion in collaborative augmented environments. *Computers Graphics*, 23 (6): 809-819, 1999.
4. V. Lepetit and M. Berger. Handling occlusions in augmented reality systems: A semiautomatic method. *Proc. Int.l Symp. Augmented Reality*, 137-146, 2000.
5. P. Milgram and S. Zhai. Applications of augmented reality for human-robot communications. *Proceedings of 1993 IEEE/RSJ International Conference on Intelligent Robots and Systems*, 1467- 1476, 1993.
6. Y. Mukaigawa, S. Mihashi, and T. Shakunaga. Photometric imagebased rendering for virtual lighting image synthesis. *Proc. 2nd Int.l Workshop Augmented Reality (IWAR '99)*, 115-124, 1999.