

THIRD EYE - AN INDUSTRIAL AUGMENTED REALITY SOLUTION

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Abstract— Third eye aims to solve the organizational requirements of an industrial setup using the features of upcoming technology, Augmented Reality (AR). This uber technology being a crucial part of Industry 4.0 for enhancing function ability and efficiency of shop-floor devices, imposes its significance through technology, organization and environment framework. This full-stack application retrieves necessary information from the backend of a dedicated server developed and maintained by Nokia Solutions and Networks which utilizes the potential of pLTE (Private Long Term Evaluation). The backend powered by 5G through Nokia's flagship Radio Unit breaks the boundaries of speed and accessibility of data while ensuring data security. The data obtained is displayed to the user through an interface integrated with Augmented Reality. The ease of accessibility of data and it's readability distinguishes this unique solution from the other similar solutions available in the market. The scope and scalability for this application are tremendous and promising.

Keywords— Third eye, Augmented Reality, Full Stack, Industry 4.0, Nokia, 5G.

INTRODUCTION

Near to being a common instrument for several activities, today's Augmented Reality (AR) technologies are. Many of these first AR devices were custom head-mounted displays (HMDs) with translucent screens and mechanisms for basic monitoring that did nothing more than reveal the position of the wearer. The virtual reality technology tools and technologies take simulation to a point beyond imagination and draw more consumers in terms of cutting-edge technological knowledge, scalable interaction models, moderate budgeting, well-defined methodologies for project execution. The virtual reality technology tools and technologies take visualization to a point beyond imagination and draw more consumers in terms of cutting-edge technological knowledge, scalable interaction models, reasonable budgeting, well-defined project execution methodologies.

Augmented reality has changed a lot from a cyberpunk dream to a fact-based reality. Until now, the costs of virtual reality were so high that designers could only dream of working on design projects that included it – things are different today and there is a much greater reality available

on the smart-phone. That means which design for augmented reality is now a choice for UX designers of all shapes and sizes. The major difference among case use and industrial use for ads, navigation, and easy visualization is that commercial use demands even greater precision in pose calculation and higher overall instrument quality. For activities such as simulating some parts of a building or showing instructions for maintenance, the quality must be better because small errors may cause some big problems.

The word Industry 4.0 emerges from the integration of new IT and data processing with advanced manufacturing technologies and processes. Smart links and data are the most symbolic features of the new age. Through Industry 4.0 the use of virtual reality is completely compatible with the ideals of the Fourth Industrial Revolution. Starting with the accessibility to data. AR revolutionizes the way we view, use and share knowledge. In fact, augmented reality is information itself which broadens the perception of users.

This technology optimizes our perception of perception and allows us to interact with knowledge. Smart factories focused on the Internet of Things and Big Data, in terms of smart output. Such a sense is completely in line with augmented reality. In reality, AR technology has the ability to contribute actively to the success and development of industrial production processes. Studies have in particular analyzed the efficiency of two groups of industrial operators related to the same manufacturing or maintenance operations: one group with AR support and one group without. The warehouse, trolleys, smart screwdriver and the tester's data are being stored in the local server in hybrid connection with Microsoft Azure Services. With the help of API programming using ASP.Net Core, the data can be accessed in various augmented reality applications in various devices such as handheld devices, Microsoft HoloLens and so on. The devices are connected in the secure and fast pLTE (Private Long Term Evaluation) network through Nokia 5G Fastlane Gateway. Here we use the Augmented Reality based sign. The QR being the marker in the factory it is easy to recognize each and every item. Unlike the other Augmented Reality solution, to achieve Augmented Reality, we use a full-stack technology approach.

The paper is organized as follows: Section II reviews the background study. Section III discusses the proposed system model with results. Section IV summarizes the current work.

RELATED WORK

Early deployment of AR, the developers conceived that the system could someday have been used to reduce costs and increase the productivity of human-involved manufacturing operations. Much more than the private sector, the US military has played a crucial role in developing AR's early uses Caudell et al.[1992]. A built-in framework demonstrated visual-only AR limitations and emphasized the need to put together multiple data sources to improve the overall usability of AR displays. Tablets and smartphones have today completely replaced AR's first wave of bulky custom HMDs Ferrin [1999]. These portable devices, although ample availability and relatively low cost, limit the mobility of the user's hands. This downside could lead to issues in many areas where AR, for example in manufacturing or maintenance, would otherwise prove beneficial. Despite this, transparent HMDs are still among the best display configurations for AR maintenance You et al.[1999].

These portable devices, although ample availability and relatively low cost, limit the mobility of the user's hands. This downside could lead to problems in several fields where AR, for example in manufacturing or maintenance, would otherwise prove beneficial. For this reason, transparent HMDs have still been found to be among the best display configurations for AR maintenance Chen et al.[2015]. While they incorporate many features effectively, such as real-time depth sensing, voice commands, and hand gestures, they also have significant drawbacks. These are not only more costly than most traditional tablets and cell phones, but they also have a very limited area of viewing and display scale, making complex maintenance operations even harder. These new HMDs represent a positive step towards the future of AR, but there are still significant obstacles that need to be addressed before mass adoption. However, if the need arises; a new display model can easily be supported by a few simple rendering modifications.

There is no question that the technology behind augmented reality is quickly evolving. Hardware and software have developed over the past two decades from costly experiments to sophisticated and affordable commercial devices that can potentially have a huge effect on many fields. Early Augmented Reality Research examined how this could lead to improvements in various sectors such as medical simulation, repair, annotation, navigation and recognition, media and the military Evans et al.[2017].

It's not enough merely to understand an engineered object. To order to further improve the productivity of service activities, the time needed for the service equipment must also be reduced. To this end, it has been shown that virtual reality decreases the time needed for various activities across a variety of industries. More precisely, it has shown that AR reduces the time needed to conduct maintenance operations considerably. AR may boost providing a technician with maintenance instructions. There is no question that speed and reliability are important factors in carrying out some maintenance work.

Nonetheless, if performed poorly, more time and rework will be needed which may result in disastrous results in the case of manufacturing which repair such as costly broken equipment, or even death in the case of surgical operations. As such, the precision with which every mission is carried out is crucial to its successful resolution. Augmented reality will certainly be an important method for enhancing the performance and precision of maintenance activities. Furthermore, if AR does not maintain the abilities and behaviors represented, the advantages it offers can be reduced. To this end, multiple studies have examined the effect AR can have on maintaining the knowledge and training staff.

From the analysis above, it is identified that the warehouse, trolleys, smart screwdriver and the tester's data are being stored in the local server in a hybrid connection with Microsoft Azure Services. With the help of API programming using ASP.Net Core, the data can be accessed in various augmented reality applications in various devices such as handheld devices, Microsoft HoloLens and so on. The devices are connected in the secure and fast pLTE (Private Long Term Evaluation) network through Nokia 5G Fastmile Gateway.

PROPOSED METHODOLOGY

AR applications for the manufacturing industry are being built for a variety of purposes including process monitoring and regulation, real-time assessment of plant layout, plant and machinery maintenance, plant and building design, and enhancement of industrial safety. Avoiding the various frameworks and resources such as Unity 3D, Vuforia, ARToolKit, ARCore reduces the project's development time. Here we use the Augmented Reality based sign. The QR being the marker in the factory it is easy to recognize each and every item. Unlike the other Augmented Reality solution, to achieve Augmented Reality, we use a full-stack technology approach.

The Third Eye , has various modules that has to be connected namely , warehouse and production quality control. The warehouse management was always a hectic process before the implementation of Third Eye. The earlier process was involving the warehouse manager to check the requirements with the ERP systems which was time consuming. Now with the help of Third Eye, the operator himself can check the contents so that the work is distributed which makes it faster and smoother. On the other hand , the production quality control was able to view the statistics using the ERP which was not adequate. They had the need to see the performance station wise so that they can improve the quality. After the implementation of Third Eye, the production quality control team had the ease of tracking each and every tester in real time which had all the statistics that were required to analyse the production quality. This helped them to improve more quality and increase the efficiency of the production rate.

Proposed Architecture

- A QR code is being stuck in the tester as well as the warehouse racks which had the unique serial number of the tester in the case of production quality control and the location of the racks in the case of warehouse management.

- The end user is equipped with a smart-phone or a smart-glass which has the Third Eye installed in it.
- The device is connected to the internet using Nokia 5G Fastmile, a device to connect with private LTE networks in order to maintain network transmission in a secure way.
- The API application service has been deployed in the Azure cloud platform. The local pLTE server is enhanced with a hybrid connection so that the azure cloud could send the request and receive data accordingly .
- The Third Eye application is designed in such a way that the resulting data from the API request is presented in the form of augmented data.

Platform which provides us with the universal API Key that can be used for various applications.

Supported Devices

- All Android Smartphone devices that have android version 5.0 and above
- Vuzix Smart Glasses
- Google Glass Enterprise Edition 2
- Microsoft Hololens Developer Edition

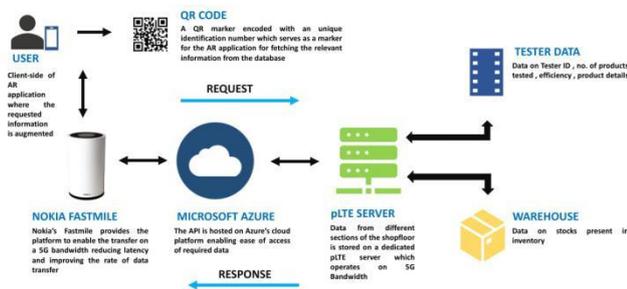


Figure 1. Proposed Third Eye Architecture

Experimental Analysis

The proposed algorithm is graphically represented for illustration below.

Framework Includes

- Augmented Reality Application
- API Key

Augmented Reality Application

As mentioned the Third Eye is designed in such a way that the back-end part is totally transferred to the API service, hence making the application lighter. The front-end of the application is developed based on the full stack approach which includes the React Native framework which includes the development of augmentation in the application.

API Key

The API plays a major role in the Third Eye, as it handles the database connections. The API application service is developed in the ASP.NET MVC model along with Web API. The ASP.NET enables us to configure the server login details and processing of the data whereas the Web API takes care of the routing protocol of the API Key. The API application service is then deployed on the Azure Cloud



Figure 2. Mock-up image of Third Eye in Smart Glass

Vuzix M300XL Smart Glass is the device used for deployment. It delivers a hands-free digital world to access unprecedented information. It also provides unique, accurate access to information and data collection.



No	Storage_Bin	Material	Material_Description	Batch
1	328-001-02	P398212	RFD LDMOSFET 400.0MHz 1.0GHz 60W	0004582547
2	328-001-02	P398212	RFD LDMOSFET 400.0MHz 1.0GHz 60W	0004581524
3	328-001-02	P398212	RFD LDMOSFET 400.0MHz 1.0GHz 60W	0004581525
4	328-001-02	P398212	RFD LDMOSFET 400.0MHz 1.0GHz 60W	0004580727

Figure 3. Screenshot of the application in smart-phone

- The data from the tester contains the no. Of products tested, the efficiency of the production for the day, etc.
- The data from the warehouse contains the data about the components and raw materials present inside a particular location.
- The tester is directly connected to the server, whereas the warehouse management data is stored in excel which is migrated to the server using a python module.

CONCLUSION

Third eye seeks to address the operational requirements of an industrial environment using the technologies of Augmented Reality (AR), an emerging technology. This uber technology being a crucial part of Industry 4.0 for enhancing shop floor devices' ability to operate and perform, imposes its significance across the context of technology, organization, and environment. This full-stack application retrieves the required information from the backend of a dedicated server built and maintained by Nokia Solutions and Networks that exploits pLTE (Private Long Term Evaluation) potentials. The back-end powered by 5G via Nokia's flagship Radio Unit breaks the limits of data speed and accessibility while maintaining data protection. The results indicate that the Augmented Reality helps the factory to achieve the transformation towards Industry 4.0.

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