altice labs

AR over GIS to make field interventions more efficient

AR; GIS; Network inventory; Netwin

White paper

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Introduction

It is undeniable that the operational costs in TELCOS' field interventions are a major concern to the operators. Augmented reality (AR) is not a 'movie scene'. It is already present in our lives, and therefore the use of it by the operators among the inventory systems will positively impact the field operational efficiency and costs.


Hotel
Bus

Augmented reality and GIS overview

AR corresponds to an interactive experience of a real-world environment where objects that reside in the real world are enhanced by computer-generated perceptual information, sometimes through multiple sensory modalities, including visual, auditory, tactile, and olfactory [1]. AR can be defined as a system that incorporates three basic features: a combination of real and virtual worlds, real-time interaction, and accurate 3D registration of virtual and real objects [2]. The overlapping sensory information can be constructive (e.g., additive to the natural environment) or destructive (e.g., masking the natural environment). This experience is seamlessly integrated with the physical world so that it is experienced as an immersive aspect of the real environment [3]. The main value of augmented reality is how the components of the digital world blend with the perception of the real world, not as a mere data viewer but through the integration of sensations, which are felt as natural parts of an environment (see **Figure 1**).

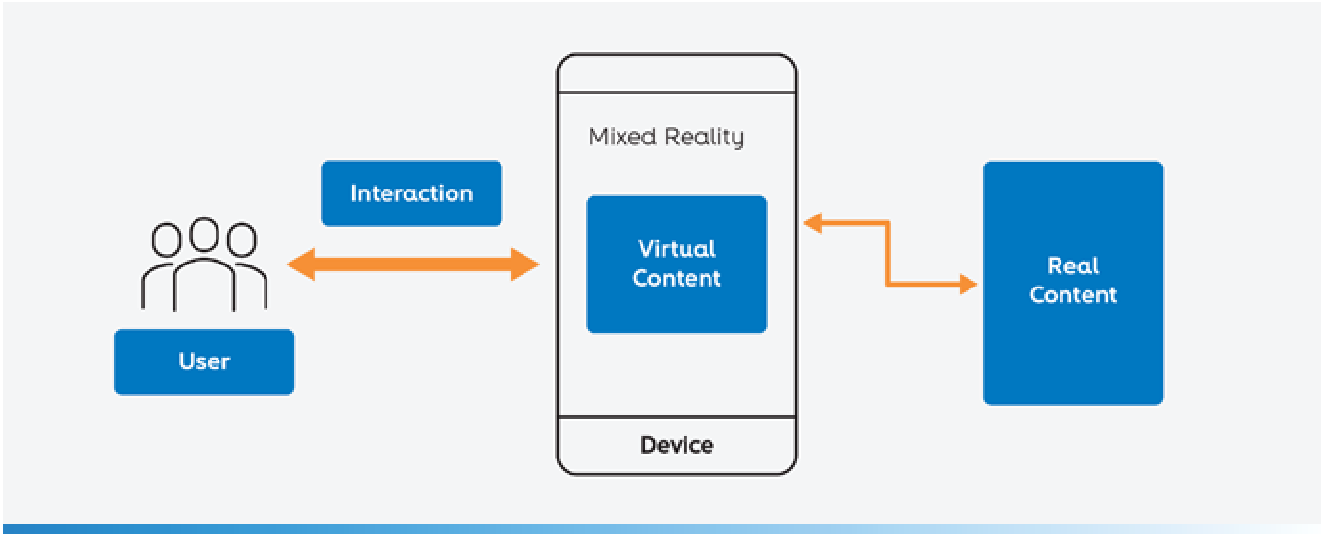

Figure 1 – How augmented reality works

The first functional AR systems that provided immersive AR experiences for users were invented in the 90s. Commercial AR experiments were first introduced in entertainment and gaming businesses. Later, AR applications spread across commercial sectors such as education, communications, medicine, and entertainment.

A geographic information system (GIS) is a system that creates, manages, analyzes, and maps all types of data. GIS connects data to a map, integrating location data (where things are) with all kinds of descriptive information (what things are like there). Such a feature provides a foundation for mapping and analysis used in science in almost every industry. GIS helps users understand patterns, relationships, and geographic context. The benefits include improved communication and efficiency as well as better management and decision-making [4].

Applying AR over GIS may be an effective solution to some problems of representing the GIS data over a 2D map.

Firstly, the representation of the data is much better linked to the real world, allowing the operator to see the GIS data in the world around him instead of connecting it to what he sees on a 2D map.

Secondly, the issues with precision and altitude may also be mitigated, as the data representation over AR is more faithful to the real objects than a 2D map representation. The accuracy advantage, however, is subject to the precision with which the AR content can be represented.

Developing mobile AR applications

While the first commercial uses of augmented reality occurred in the entertainment and video game industry, many other sectors such as education, data maintenance, and inventory management are also interested in taking full advantage of this approach [2].

The AR solutions in this domain will use the mobile equipment's location sensors, camera, or functionality. Thus, it makes sense to explore and consider the functions and the orders of precision of data they are capable of registering. This way, we can identify limitations in the proposed tools and, in the future, if such a possibility arises, identify the most effective equipment for the use of some proposed solution.

In the market, there are frameworks and tools that can be used to access AR features in mobile equipment. The ones that provide more flexibility and features are the multiplatform frameworks, which allow access to the native software development kit (SDK) features and add value on top of it.

One of the most relevant is the Unity framework [5]. Despite being most often associated with game development, this framework has a pertinent quantity of tools for 3D development that allows the implementation of AR applications. There are several SDK to develop over Unity, the most relevant of them being Vuforia and Wikitude [6].

One relevant aspect of using the Unity framework is that it allows to be incorporated into native applications of the equipment [7].

AR applied to network inventory

A network inventory product stores and provides information on network resources and their relationships. They include physical resources, like infrastructures (buildings, manholes, poles, strands, etc.), cables and types of equipment (racks, boards, ports, etc.), and logical resources (managed elements, VLAN, software, network topologies, VNF, etc.). Thanks to the smooth integration between network and IT, we have seen network inventory systems evolve to cover the IT world. As so, they are increasingly becoming more 'resource inventory systems'. Some of them, like Altice Labs' NOSSIS One Inventory (Netwin) [8], also include service inventory functionalities, providing a complete service-resource layered navigation, through GUI and API, according to worldwide standards and references, like TMForum.

The main goal of service and resource inventory systems is to support the operational processes of a service provider, namely the concept-to-market (C2M), the lead-to-cash (L2C), and the problem-to-resolution (P2R) processes. C2M deals with demand planning, network development (planning, construction, and inventory), and IT/service platform implementation to ensure service delivery readiness. The L2C process manages service fulfillment, including resource allocation, service activation, customer installation, and billing activities. It assures service delivery to the customer. P2R deals with network monitoring and resolution, preventive network maintenance, and customer problem resolution (service diagnostics and service repair).

Some activities of those processes require manual intervention on physical resources, most of them located on the outside plant, where some infrastructures and cables are underground. Network construction, customer installation, customer repair, and network outage resolution are examples of activities typically performed by technicians in the field that require access to the information available from inventory systems. Today, it is common to have mobile apps that are adaptations of the originating web applications to guarantee access to data from a smartphone or a tablet. Others are specific standalone mobile apps where inventory information is added to ensure the technician can perform his job. The majority are based on traditional 2D technology with georeferenced inventory data presented over a map, with some usability limitations and the subsequent impact on technician operational efficiency.

AR technology can be an alternative to the development of these mobile apps to present network inventory data. **Figure 2** shows the difference between using a 2D traditional approach and using AR to show infrastructures and underground cables.

Figure 2 – 2D traditional approach vs. AR approach

With AR, the technician sees the inventory information on the screen on top of the real world captured by his device camera. When he walks through the street, the information on the screen changes in real time, aligned with his new locations. This new way of interacting has an enormous potential to simplify the work, reducing the time the technician needs to access the information he needs to perform his job.

Netwin FTTH use case

Fiber-to-the-home (FTTH) is a passive optical network (PON) technology used in the access network domain to let fiber into the home, providing high bandwidth at competitive prices for broadband residential and enterprise services.

This innovative technology caused a revolution in access networks introducing new challenges to operational processes and OSS systems. Advanced GIS inventory applications, like Netwin, are part of the solution and help fiber network operators to plan, develop and operate their networks efficiently.

Netwin provides intelligent network design, construction status, inventory accuracy with ready-for-service validation, and open API to support L2C and P2R processes.

FTTH operation processes include activities in the field such as customer installation and repair, and network outage handling, done by qualified technicians that need georeferenced information from service and resource inventory. Netwin provides a mobile AR app designed to provide the best usability and simplify technician tasks.

Using the AR capabilities of Netwin AR, the technician can see the Netwin information on top of the visible area so that he can have an overview of nearby network entities. **Figure 3** illustrates this situation, showing the FTTH physical infrastructure, underground cable ducts, manhole installation points, and optical distribution points (ODP) equipment in the real world.

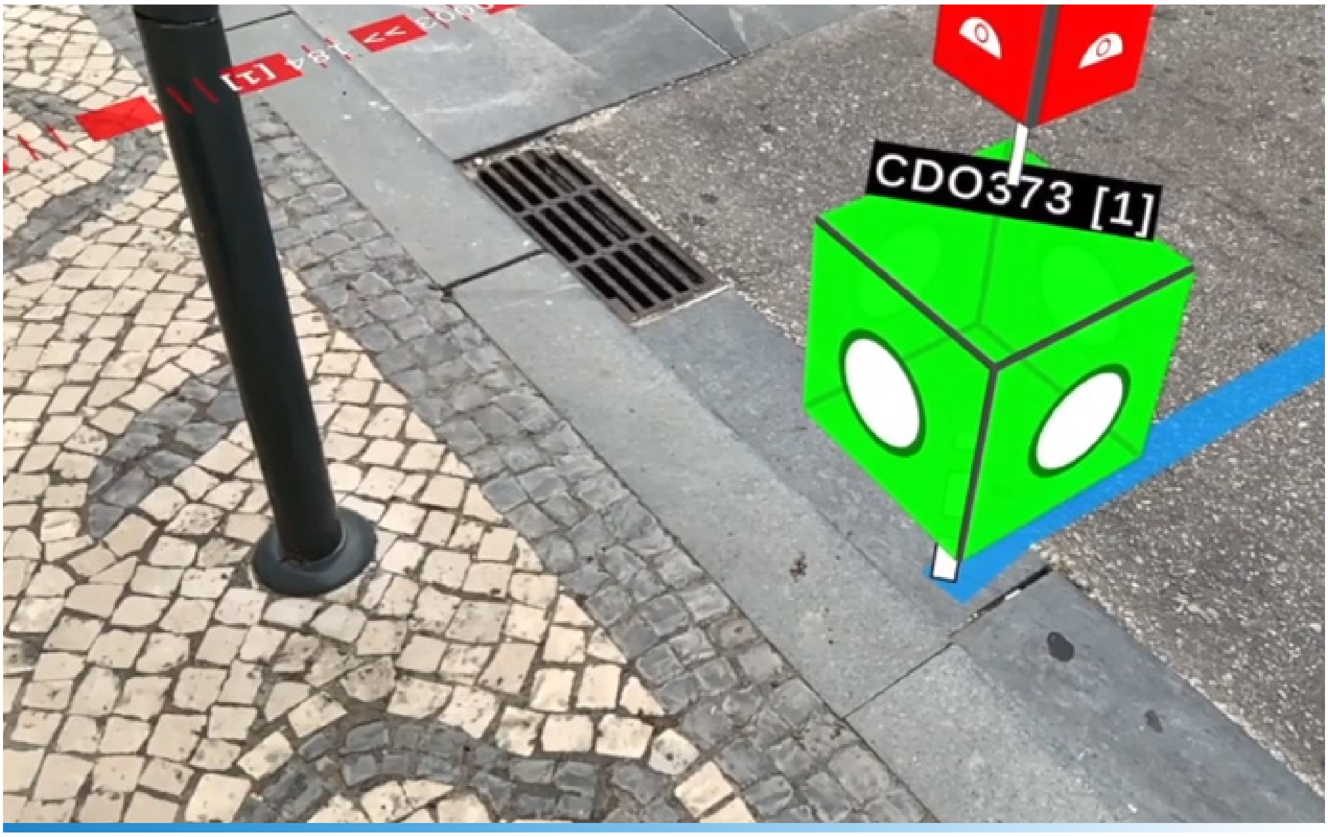

Figure 3 – Underground equipment

With a simple touch, the technician can see the characteristics of the elements (as shown in **Figure 4**), locations, strands, cables, equipment, and services. He can also perform data modifications and correct inventory errors.

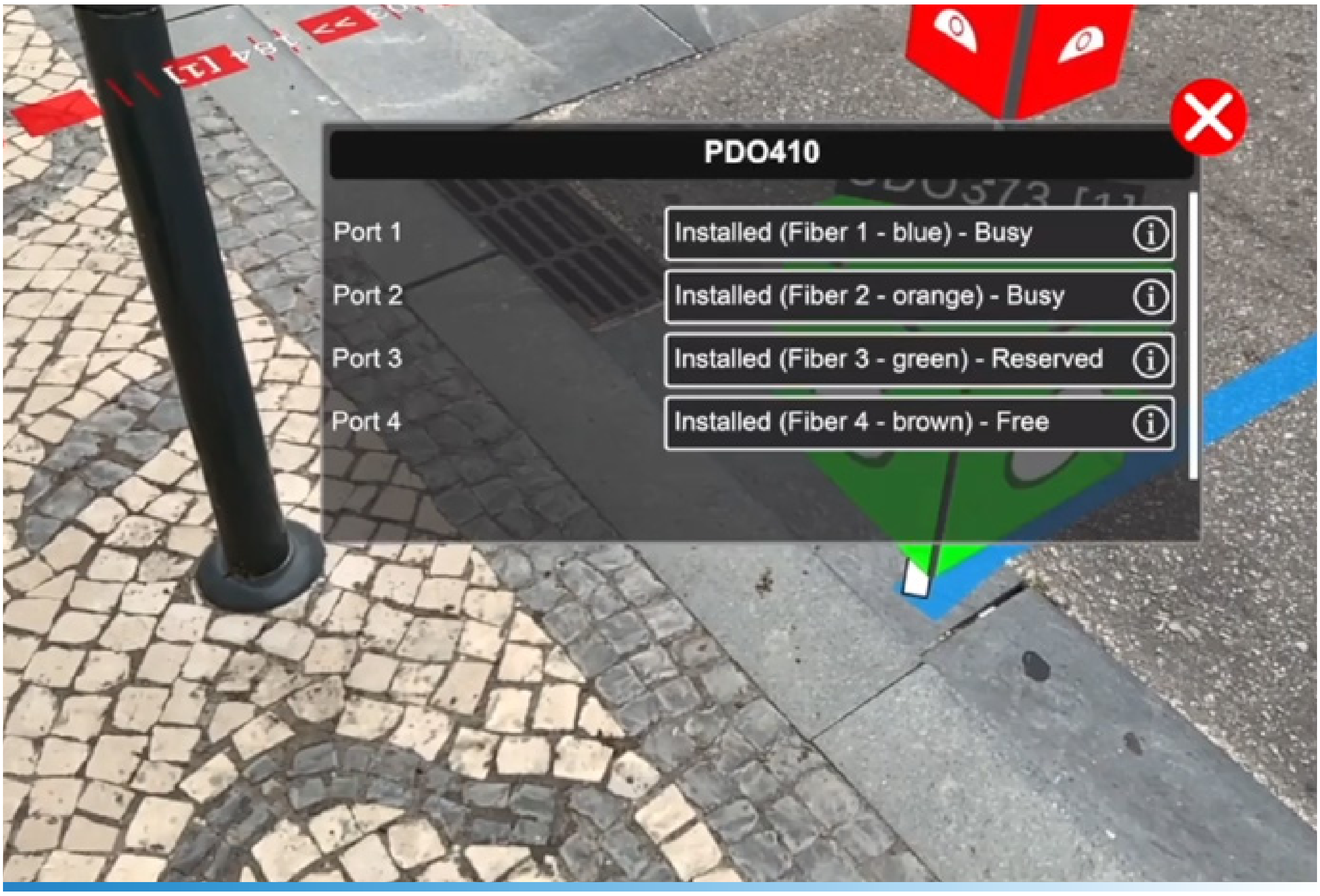

Figure 4 – Detailed information on the visualized equipment

Another interesting functionality is the ability to search for elements. In this situation, Netwin AR will guide him to the destination. This feature is shown in **Figure 5**.

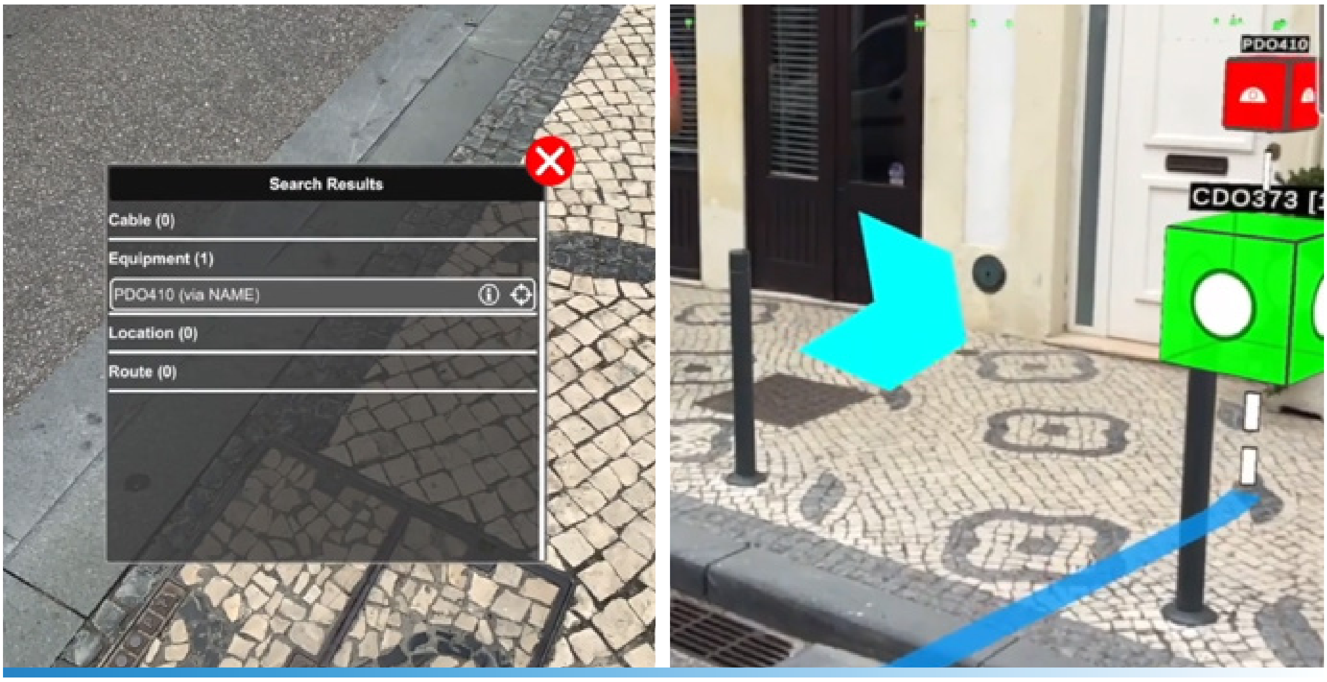

Figure 5 – Search elements

Conclusions

This article provides an overview of augmented reality technology and its application to view georeferenced network inventory information in mobile devices and help improve technicians' operational efficiency in the activities of L2C and P2R processes. The use of AR instead of traditional 2D technology is a disrupting innovation that opens an enormous potential for network inventory GIS-based applications, namely regarding usability and speed of accessing information.

A use case of AR applied to network inventory was presented based on Altice Labs' Netwin AR app for FTTH. The use of AR technology was described, and some examples were given. The app provides FTTH Netwin information in the field, on top of real-world information, using smartphones or tablets. This innovative approach can simplify the technicians' work: they will have a more natural and rapid way of seeing the information, which improves their operational efficiency.

References

[1] P. Panchapakesan, "Managerial Challenges in VR and AR in Asia," in ***Managerial Challenges and Social Impacts of Virtual and Augmented Reality***, IGI Global, 2020, pp. 44-54

[2] Eastern Kentucky University, "Research Guides: Geek Immersion Labs: Augmented Reality (AR)," 25 02 2022. [Online]. Available: https://libguides.eku.edu/c.php?g=1149337&p=8388804

[3] Shreya Mattoo, "What Is Augmented Reality and How Can It Drive Growth?," 3 6 2022. [Online]. Available: https://www.g2.com/articles/augmented-reality

[4] Esri, "What is GIS? | Geographic Information System Mapping Technology," 2022. [Online]. Available: https://www.esri.com/en-us/what-is-gis/overview

[5] Unity, "Unity," Unity Technologies, 2022. [Online]. Available: https://unity.com/

[6] PTC Inc, "Vuforia Developer Library," 2022. [Online]. Available: https://library.vuforia.com/getting-started/getting-started-vuforia-engine-unity

[7] Unity Technologies, "Unity as a library," 2022. [Online]. Available: https://unity.com/features/unity-as-a-library

[8] Altice Labs, "Network Development & Inventory – Altice Labs," 2022. [Online]. Available: https://www.alticelabs.com/products/network-development-and-inventory/

Acronyms

2D	Two-dimensional
3D	Three-dimensional
API	Application Programming Interface
AR	Augmented Reality
C2M	Concept-to-Market
FTTH	Fiber-to-the-Home
GIS	Geographic Information System
GUI	Graphic Users Interfaces
IT	Information Technologies
L2C	Lead-to-Cash
ODP	Optical Distribution Point
OSS	Operation Support System
P2R	Problem-to-Resolution
PON	Passive Optical Network
SDK	Software Development Kit
TM Forum	A non-proft industry association for service providers and their suppliers in the telecommunications industry
VLAN	Virtual Local Area Network
VNF	Virtualised Network Function

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