

## HOW TO DEPLOY AUGMENTED REALITY IN DISTRIBUTION SYSTEM OPERATOR

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### ABSTRACT

*In the past, Elektro Ljubljana d.d. experienced IT support limitations which failed to follow the demands of business processes and the new approaches to planning and managing the maintenance process. Concrete operational difficulties arose, such as poor and incomplete monitoring of data on the condition of assets, which prevented fast and optimal decision-making regarding measures and investments into the existing infrastructure and investments into extensions and renewals. The decision for the implementation of the EAM (Enterprise Asset Management) solution of the IBM Maximo Asset Management information system has proven to be a great success and lays a new foundation for asset control. At the same time, it enables further development in the field of asset management and a constant search for solutions to address new challenges. Therefore, a decision has been made to launch a development partnership with TROIA d.o.o. and to implement the T-SENSE smart platform. The basis of this platform is AR–Augmented reality in connection with smart algorithms, which enable data analysis and operations, as well as predictive behaviour with regard to maintenance. Through the T-SENSE platform, the infrastructure can be easier and better maintained, and in particular, we can have a positive impact on the minimization of errors, better performance, cost reduction and predictive behaviour. Ergonomic glasses, which are an integral part of the T-SENSE platform, have a wide viewing angle and represent a user-friendly and intuitive user interface that can be managed hands-free, which means that you can focus entirely on what you are doing.*

### INTRODUCTION

Elektro Ljubljana d. d. is the leading company in network activities and provides a wide range of commercial services related to the electricity infrastructure in central and south-east Slovenia. It is currently responsible for the biggest distribution network in Slovenia and owns the infrastructure that provides electricity to a large part of the country.

The company connects and integrates advanced electricity supply services in order to provide a safe, reliable, high-quality, and sustainable system for the distribution of electricity, while focusing intently on fulfilling the needs of both commercial and household customers.

With effective and innovative solutions in the field of electric energy supply, they are the leading partner in

energy distribution development on national and local level and the leading group for managing modern energy infrastructure networks with appropriate revenue for owners and incentive work environment for employees.

Company TROIA d.o.o. is the leading implementer of IBM Maximo Enterprise Asset Management in Slovenia. Troia has the highest IBM partner status for IBM Maximo implementation and a team of over 20 experts for IBM Maximo implementations.

The company has reference projects in Slovenia and abroad and is present in SE Europe, Baltic and Middle East.

Troia T-SENSE AR platform is an online platform, installed in the cloud, and intended to connect back end information systems like EAM, ERP, GIS, SCADA and IOT platform with augmented reality glasses. The platform includes algorithms for machine learning in real time and enables the use of SCADA data and their analysis for the improvement of work productivity. It can be used in the office as on the field and it can be linked with various information systems, in this case, with IBM Maximo.

### MAINTENANCE AND AUGMENTED REALITY

In the past Elektro Ljubljana d.d. experienced IT support limitations which failed to follow the demands of business processes and the new approaches to planning and managing the maintenance process. Concrete operational difficulties arose, such as poor and incomplete monitoring of data on condition of assets, which prevented fast and optimal decision-making regarding measures and investments into the existing infrastructure and investments into extensions and renewals. The decision for the implementation of the EAM (Enterprise Asset Management) solution of the IBM Maximo Asset Management information system has proven to be a great success and lays a new foundation for asset control. Constantly looking for solutions to challenges they were facing, they decided to start a development partnership and implementation of T-AR smart platform, that is based on augmented reality (AR), in connection with smart algorithms of T-SENSE in the cloud, that enables analysis and managing data and predictive behaviour in the field of maintenance.

Augmented Reality (AR) is a technology meant to enrich users real-world experience. And maintenance is one of AR's most addressed and researched fields of application.

AR provides real-time support to maintainers by embedding information into their interaction with the assets to maintain. Therefore, AR can help increase safety and/or reduce cognitive workload, errors and/or duration of tasks. [1]

IBM Maximo Asset Management is an integrated tool for productivity and database, that helps with managing all types of assets on one single platform. Maximo Asset Management is based on SOA architecture and offers a thorough display of all types of assets, their condition and location and supporting work orders. The Maximo database offers key information about resources, key attributes, their configuration and their physical and logical relations with other sources.

Virtual Reality is a technology which allows a user to interact with a computer-simulated environment, whether that environment is a simulation of the real world or an imaginary world. It is the key to experiencing, feeling and touching the past, present and the future. It is the medium of creating our own world, our own customized reality. It could range from creating a video game to having a virtual stroll around the universe, from walking through our own dream house to experiencing a walk on an alien planet. With virtual reality, we can experience the most intimidating and gruelling situations by playing safe and with a learning perspective. [2]

Smart AR-glasses and Troia T-SENSE solution will change our view of work and productivity. They are useful in many fields, inside and outside, with many possibilities of application use and integration on existing information systems (IBM Maximo, others...). The users can work, plan, maintain and cooperate simply better and upgrade their work with additional data. Ergonomic glasses have a wide viewing range and because of the user interface, the user doesn't have to use hands and can focus entirely on the work.

The intention of smart AR-glasses is to enrich the current environment and work orders with information, that will help workers do their work better, faster and more precise. The use of AR-glasses helps the user to: better maintain assets, early detection of possible errors, easier inventory of assets... AR glasses can also be used as a tool to educate employees for all different tasks.

## T-AR PLATFORM AND USER APPLICATION

The use of smart AR glasses, that enables maintenance teams on the field a new dimension of informational support and source of information, presents a new milestone and a big step ahead of the competition. With the help of T-AR platform they can maintain the infrastructure better and influence the reduction of errors, better efficiency, predictive maintenance and cost reduction.

The intention of T-AR platform is to upgrade the current work environment and tasks with information, that can help the employees do their work better and faster, since the T-AR platform allows: remote assistance users on the field, more reliable maintenance, early error detection, more precise work on the field...



Picture 1 Monitoring data from IBM Maximo and IOT devices. [DAQRI IBM Maximo Web site – [www.daqri.com](http://www.daqri.com)].

Users can take advantage of full functionality of augmented reality technology. With smart AR-glasses you can improve:

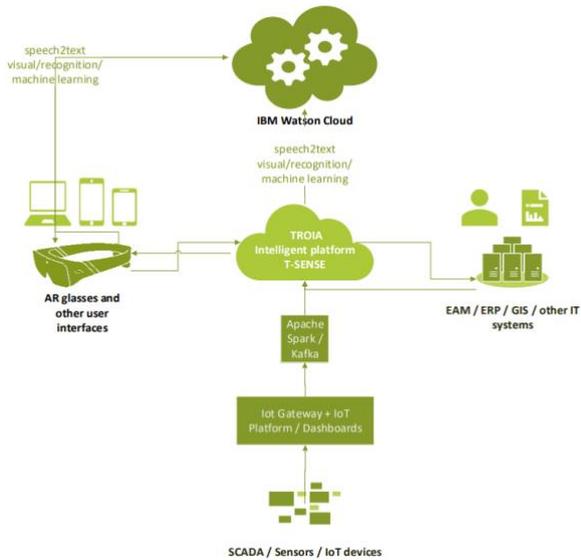
- Cooperation, that includes: Content sharing, joint performance of tasks and setting up a video conference.
- Labelling, that includes: visualisation of work orders and plan of equipment, effective management of work orders.
- Modelling, that includes: Advanced visualisation (eg. BIM\*\*) and content management.
- Monitoring work activities and progress.

## T-AR PLATFORM

Intelligent T-AR platform presents an online application and a range of technical solutions, that can run in the cloud or on-premise and have the tasks of combining information from different sources (IBM Maximo - EAM, ERP, GIS, IOT, SCADA and other back end systems) and properly process those data with the help of smart algorithms, to give the user a display on various media: T-SENSE, AR glasses, smart phone or tablet.

Intuitive user interfaces enable an easy use and fast review and control over the current state. The user can get to the information in the moment, which helps with getting the work done faster and more efficiently.

T-AR platform, that takes care of the time flow of information and mutual interaction, also has IBM Watson Cloud services for voice recognition and visual recognition of assets and labels, implemented.



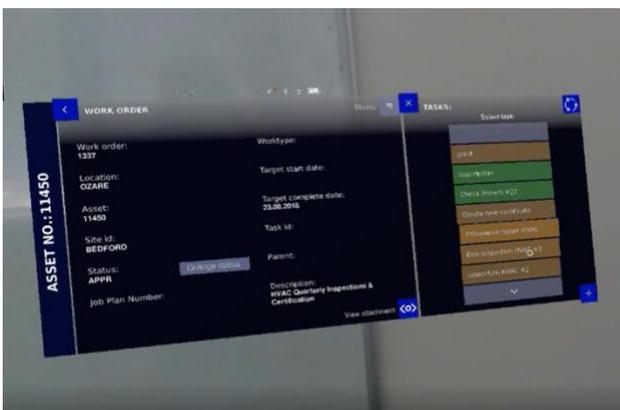
Picture 2 Architecture of the T-SENSE platform.

## APPLICATION DESCRIPTION

### AR application T-WORKMANAGER

Application T-workmanager for AR glasses is meant as a support with asset management on the field, where we can identify the asset and have a interactive view of work orders and tasks. We can change the state and priorities of work orders and tasks, add new tasks and attachments (photos), linked to a specific asset.

There is also the possibility of interactive view within the application, overseeing the data from the sensors. We can manage and update the value of sensors with our voice – IBM Watson Cloud »Speech2Text« integration«



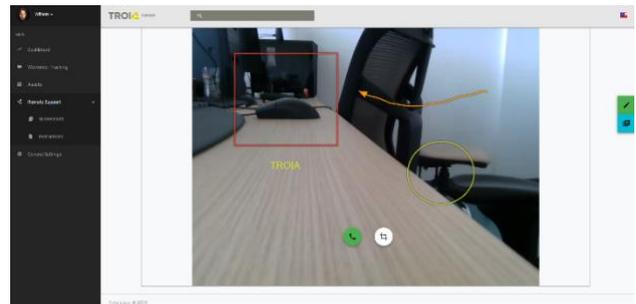
Picture 3 Work orders and tasks on glasses.



Picture 4 Review of the SCADA / IoT readings on the glasses.

### AR application T-REMOTE

T-remote application for AR glasses is meant for effective support and knowledge transfer at distance with the help of video call and voice communication and elements of augmented reality, we can draw and add in T-SENSE interface and will be shown on AR-glasses. There is also the option of adding instructions as text, pdf documents and screensharing.



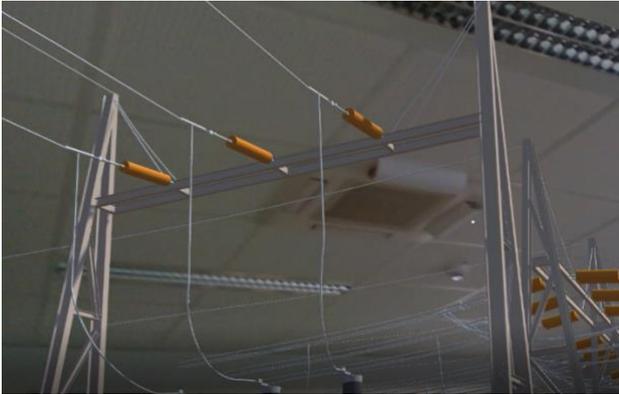
Picture 5 Application T-REMOTE for remote support.



Picture 6 Application T-REMOTE for remote support.

**AR application T-BIMMANAGER**

T-BIMMANAGER application for AR glasses is meant for interactive 3D visualization of assets placed in realistic world. There are smart tags integration of digital gauges which could be placed all around the field on different assets.



Picture 7 AR application T-BIMMANAGER.

**AR application T-TAGMANAGER**

T-TAGMANAGER application for AR glasses is meant for interactive visualization of smart tags (digital gauges, workorders, etc) pinned on assets placed in real world.



Picture 8 T-TAGMANAGER AR application.

**»Smartphone« T-METER application**

Application for smart phones and tablets T-METER uses augmented reality technology for real-time view of measuring devices on an asset (sensors). IBM Watson Cloud solution »Speech2Text« is also implemented, with which we can manage and update the value of indicators by voice.



Picture 9 QR code placed on Asset and links ASSETNUM from IBM Maximo.



Picture 10 AR info real-time content about asset sensors displayed over QR code.

## FURTHER DEVELOPMENT ROADMAP

In the future, we plan on continuing our development work and integrate new supportive applications and workflows for the work process on the field. Our main goal is to simplify fieldwork, increase safety, gain new insights and reduce errors and delays.

- Supportive apps for measurement points and smart meters readings.
- GIS inspection AR apps to simplify utility locates, assess hidden infrastructure and increase productivity.
- Monitoring of balance of assets, comparison by time-line.
- Monitoring of measurable data – on location.
- Preventive underground cable inspection and detection of defects or failures on infrastructure.
- Smart meters checking in the street – locations, problems, etc.
- Preventive inspection applications for power stations and power substations.



Picture 11 AR GIS solution. [VGIS Web Site – [www.vgis.io](http://www.vgis.io)]

## CONCLUSIONS

Troia and Elektro Ljubljana are currently participating on a development project in which certain services have been implemented. With the implementation of the whole solution in production use, Elektro Ljubljana will benefit and improve:

- Interactive support and content sharing on field (with T-WORK MANAGER application).
- Appropriate support via video call and possibility of visual feedback (T-REMOTE / SHOW application).
- Visualisation of work orders and tasks, updating information from the field directly with IBM Maximo and other back systems (T-WORKMANAGER).
- Reading and updating meters on field (T-METER).

- Advanced interactive visualisation of 3D BIM models with visualized content (interactive gauges) from back-end data systems and IoT platform (T-BIMMANAGER / T-TAGMANAGER).

## REFERENCES

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