# Augmented Reality – Industrial use case

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**Annotation**: This paper is concentrating on using augmented reality technology to display energy data of the machines in the experimental center belonging to University of Technology in Chemnitz. It is showing the industrial use case for augmented reality technology. The target is to present the students this modern approach of data visualisation. The article describes experimental center with its industrial equipment, augmented reality technology, HelpLightning Augmented Reality Solution and own industrial use case of implementing HelpLightning solution in experimental center.

## 1 Introduction

Manufacturing is very competitive business environment. One of the important topics of manufacturing is to have actual production data easily accessible. Nowadays we can use many solutions to easy access them. We can have access to the data in local secured network, we can access data online on the cloud that not bonds us to the local network. We can use displays, screens positioned in the production plants to see the data and we can access them by computers, tablets, cell phones etc. These approaches missing one important thing and that is easy visual connection between machines and their relevant data. This can be overcome by using augmented reality technology. This paper is concentrating on using augmented reality technology to display energy data of the machines in the experimental center belonging to University of Technology in Chemnitz. The target is to present the students this modern approach of data visualisation.

## 2 Experimental Center – TU Chemnitz

The experimental center belongs to University of Technology in Chemnitz (TU Chemnitz). It is supposed to provide practical learning factory for research, development and education. It is mainly concentrated on Industry 4.0 technologies, specifically - digitalization, networking of machines / systems, IoT, Cloud data etc. Relevant focus is also on energy/resource efficiency of production. [1]

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The experimental center contains above others following equipment [2]:

- Assembly line - assembly, disassembly, manufacturing, handling and testing systems and processes
- Factory automation system with cloud, ERP, IoT, MES and PLC for control and visualization (e.g. B&R, Siemens, Wago, MQTT, OPC UA, NodeRed)
- Storage system with automated storage and retrieval vehicle accompanied by electrical forklift
- Identification and localization systems: AutoID (barcode, Bluetooth beacons, RFID, RLTS, UWB)
- Energy data management, energy monitoring
- Automated guided vehicles (AGV) with various concepts and applications (high tech – low cost, navigation systems, mobile robots)
- etc.

The overview of the experimental center can be seen on the following figures 1 and 2.

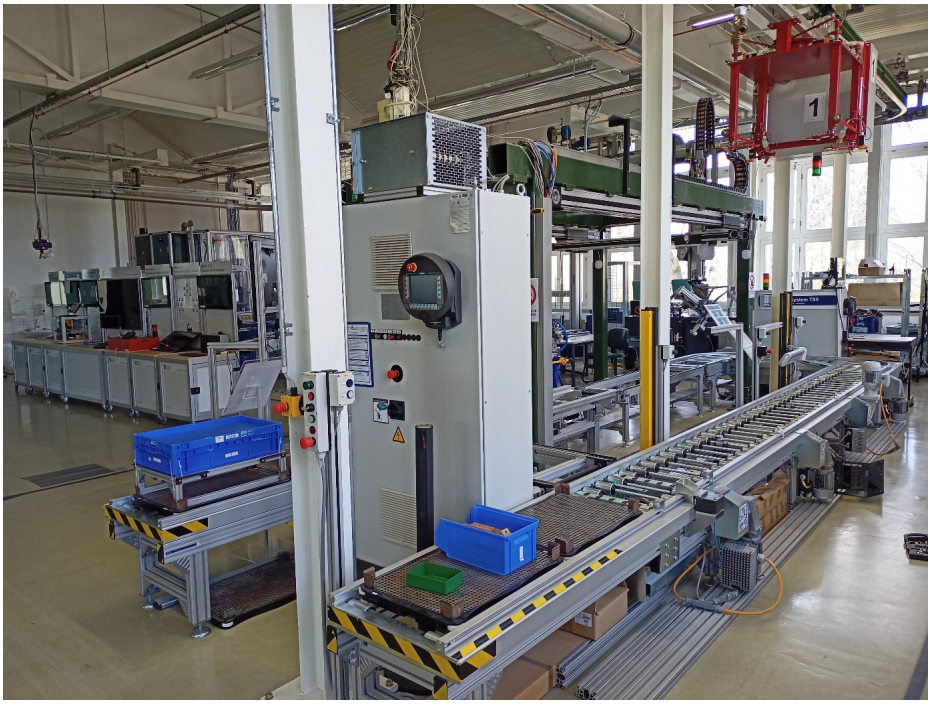

*Figure 1 – Assembly line - Experimental Center*


*Figure 2 – Storage system - Experimental Center*

# 3 Energy monitoring in experimental Center

Important system included in the experimental center is energy data management and energy monitoring. This system is linked to the three AGVs, lighting of the experimental center, assembly line, storage system with automated storage and electrical forklift.

The system collects electric power data (mostly active, reactive and apparent power) of assembly line, lighting and storage system, together with current battery voltage of AGVs and electrical forklift. The overall operating status of the mentioned equipment is also collected by the system.

The energy data was used to pointed out the sustainable development that can be linked to them. It can be on the basis of future Eco – innovation. [3] The energy data are also important input for environmental assement of the company. [4]

The overview of the energy monitoring status of experimental center can be seen on the display in the experimental center. Battery status of the mentioned equipment is shown on the figure 3.


*Figure 3 – Energy monitoring - Experimental Center*

# 4 Augmented reality

There are many definitions of the augmented reality. The one that the authors of the paper consider relevant and that points out also the difference between the augmented and virtual reality is the one from Gartner. The augmented reality according to Gartner is [5]: “Augmented reality (AR) is the real-time use of information in the form of text, graphics, audio and other virtual enhancements integrated with real-world objects. It is this "real world" element

that differentiates AR from virtual reality. AR integrates and adds value to the user's interaction with the real world, versus a simulation."

Augmented reality has wide usability in general and also in the industral environment. In the industrial environment can be for AR with advantage used 3D models (products, machines etc.) that are used in industry for variety of applications, for example for computer vision or 3D printing. [6], [7]

Example of augmented reality that shows the real machine with virtual enhancement in form of text with the name of the machine + additional value is on figure 4.


*Figure 4 – Augmented Reality - example*

# 5 HelpLightning augmented reality application

For the testing of augmented reality in experimental center was chosen the HelpLightning augmented reality application. It provides the desired functionality - showing online data linked to specific machine / equipment in augmented reality.

The application provides also other important functions like navigation and connecting the augmented reality to knowledge items (for example: pdf files,

video etc.). Regarding the knowledge items, the functionality is that you can see not only online data linked to specific machine / equipment but you have also easy access to its manual etc. Navigation functionality means that once you are in a scene you can search for a specific instrument or sensor. The application will guide the user to the device.

The HelpLightning application is based on cloud solution that could be linked with company database to provide important data to be shown in augmented reality.

Example of HelpLightning augmented reality is on the figure 5.

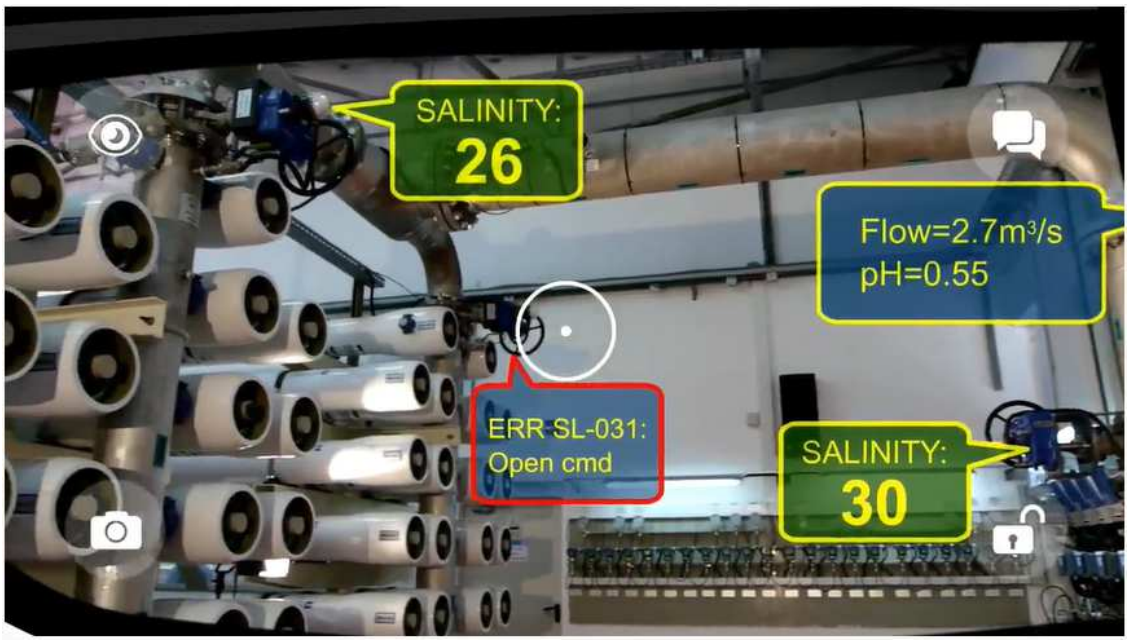


*Figure 5 – Augmented Reality – HelpLightning application [8]*

# 6 Augmented reality use case – Experimental center

In our use case we planned to show the actual energy data in augmented reality environment. With target to show this modern possibilities to students of TU Chemnitz.

Our approach was based on experimental center and its machines / equipment, energy data monitoring of the specific machines in experimental center and augmented reality application – HelpLightning. Our hardware planned to be used for the application: Mobile phone: OPPO Reno 4 Z 5G and tablet: Samsung Galaxy Tab S3.

After the installation of the application, mapping process of the machines was started. Relevant machines were mapped and special AR nodes that shows the name and can carry the online data information (and knowledge items etc.) were setted. The energy database of TU Chemnitz by using MQTT protocol was connected to the HelpLightning application and specific online data relevant for each of the machine were linked. Two examples of mapped AR nodes with energy data and the name of the equipment is on the figure 6.

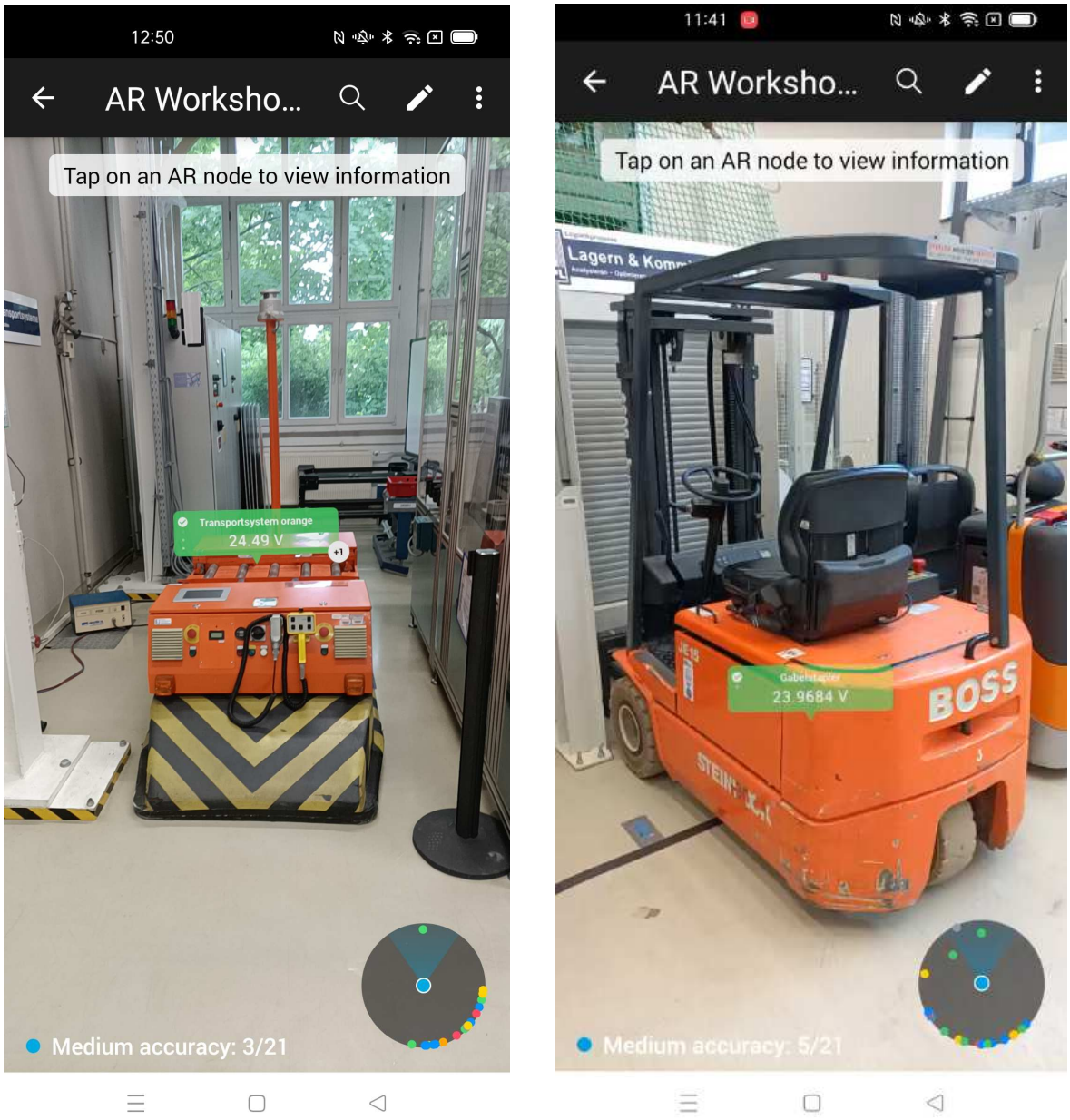


*Figure 6 – Augmented Reality – Experimental center use case*

After the setting of the system each time you are opening the scene, the mapping of the application has to be done. By mapping is understand the recognition of the AR nodes at specific locations. Our general experience is that this recognition is fast and during the mapping process of AR nodes the system is more and more accurate.

# 7 Conclusion

The paper was concentrated on using augmented reality technology to display energy data of the machines in the experimental center belonging to University of Technology in Chemnitz. The target was to present the students this modern approach of data visualisation.

The solution that was used was HelpLightning augmented reality solution. The implementation of the solution to the experimental center was successful. HelpLightning provides easy to use and easy to implement solution that can show the relevant data where it is needed.

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