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# Factory of the Future Automation Set Up for Process industries

**Abstract:** Today's graduate of university of technology must be a designer with multidisciplinary background; he has to understand the basics in chemical engineering, modelling and simulation, process control and automation, hybrid systems in processes to be able to effectively connect and configure unit processes, production lines and the whole plant. Implementation of Big Data, IoT and Cloud computing methodologies in research is an essential part of multidisciplinary learning, especially in higher education. There is a need for a modern factory of future automation set up which gives an opportunity to perform high quality multidisciplinary research and education across the schools borders and to serve our global process industries' needs. There is a need for open data valley to co-operate with our customers in industries and colleagues in international research centers. Currently, there is no ready open cloud environment especially designed for process industries. Therefore, the aim is to further develop our Factory future process automation set up, and enable the open connectivity, data analysis, and algorithms development in Siemens MindSphere and Microsoft Azure environments.

**Keywords:** IoT, cloud computing, OPC UA, advanced control, data analytics, Azure, MindSphere

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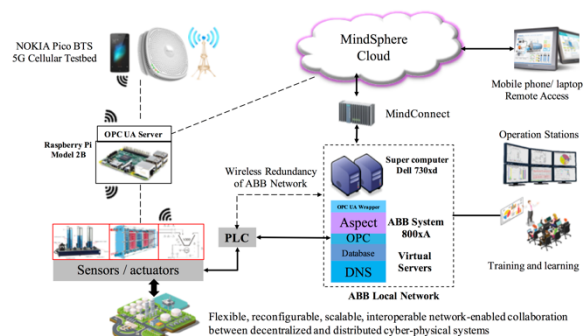
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## 1 Status of the Factory of Future Automation Set Up in Abio Today

The factory of future automation setup consists of ABB System 800xA DCS with the duplicated main servers, as shown in Figure 1. Configuration stations and operator stations are virtualized Windows workstations. They are installed in two highly efficient physical Dell 730xd servers that can be accessed remotely for the training and learning purposes. The sensors / actuators can be accessed through the real-time Ethernet and PLCs (Programmable Logic Controller), or Rasberry Pi I/O Gateway by utilizing the 5G cellular testbed network to provide the redundant wireless access with low latency for the installed equipment.

## 2 Control and IO modules

Control and I/O module of ABB System 800xA consists of standards-based hardware and software with industrial I/O interfaces. Information management module of ABB System 800xA collects, stores, and presents the real-time process, historical and business data. The OPC UA Server provides OPC UA client with access to the System 800xA. From the OPC UA servers address space the OPC UA clients can read measurements and manipulate parameters.



**Figure 1.** Overall Architecture of the Factory of Future Automation Set up

### 3 Further Development of the Future Process Automation Set Up

#### 3.1 Open Connectivity

In the setup, the data is collected from OPC UA data sources via MindConnect Nano gateway into MindSphere cloud computing system where the data can be visualized and analytics algorithms can be executed for the data, as illustrated in Figure 2. The OPC UA connection has been implemented with MindConnect Nano to make possible the automation set up and companies to connect into the MindSphere cloud. MindConnect Nano is a hardware device that establishes the connection to MindSphere in order to collect data from an equipment and transfer it to MindSphere.

MindConnect Library provides a software development kit (SDK) which enables self-programming of the customer or the use case specific connectivity agents. It supports encrypted transmission of on-site data to MindSphere through a secure internet connection, to enable cloud-based applications and services.

#### 3.2 Development of the FDD and machine learning algorithms

The Azure and Cloud Foundry are platforms as a service (PaaS), providing a development and deployment environment together with MindSphere. The MindSphere Cloud Platform provides a variety of supporting services to make application development easier. Through the APIs different processes can be automated, i.e. manage users and assets, retrieve and store Industrial IoT data. In addition, the third-party algorithms, such as scikit-learn, and applications can be included into the set up. The proposed advanced teaching and process monitoring system is currently being evaluated with test-algorithms implemented in the Azure and Cloud Foundry cloud.

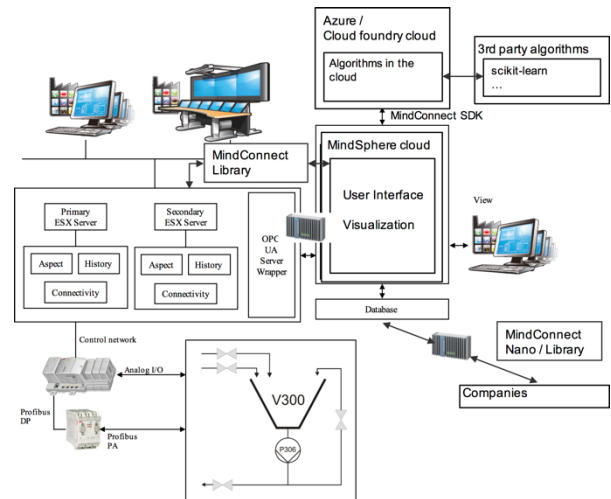


Figure 2. Cloud platform of the Factory of Future Automation Set up

### 4 Future research

The future research of the set up includes the evaluation of the proposed advanced teaching and process monitoring system and the implementation of the custom developed algorithms in the Azure and Cloud Foundry cloud.