Cloud-Based Industrial Automation
Reliable, cost-saving control across facilities for a range of processes

Developed at Qatar Computing Research Institute (QCRI), this cloud-based system can be used to monitor and control a wide range of industrial processes—from simple monitoring of security cameras to managing and controlling complex industrial plants in various locations. The innovative platform consists of proprietary algorithms and software running on servers in a cloud environment to control all layers of automation, including field-based control of process monitors and controllers, the human-machine interface, and plant- or corporate-level data monitoring and optimization. It is capable of compensating for delays and latency in the communication between the field devices and cloud-based servers. It also adds reliability by automatically switching controllers in the event of a failure and ensuring smooth operational handover between controllers. The use of cloud-based controls offers tremendous savings in terms of cost and time for implementing, installing, commissioning, and maintaining the system. It can even control and manage worldwide industrial operations from a central location.

Technology Benefits

- **Low cost**: Reduces upfront costs significantly due to the reduction in hardware
- **Reduced labor**: Requires less engineering, commissioning, and maintenance labor due to sophisticated virtualization and visualization features
- **Faster setup**: Can be implemented three times faster than traditional hardware-based controls
- **Effective**: Provides cloud-based performance that is indistinguishable from local controllers
- **Versatile**: Can act as a backup system, temporarily manage systems during upgrades/repairs, and serve multiple facilities thousands of miles apart
HOW IT WORKS

Sensors and actuators are connected to the cloud using field-level protocols that run on top of the transmission control protocol (TCP). For the direct control layer, algorithms poll sensors and send commands to actuators over the Internet. A compensator reduces the impact of large and variable Internet delays, while control automatically switches to an alternate the event of a primary controller failure. For supervisory control, human-machine interface, and other control room applications, this system replaces the complex traditional environment—servers, workstations, network switches, and cables—with “thin clients” running on much simpler hardware.

Cloud-based control is straightforward for plant-level optimization and enterprise-level management, with their more relaxed timelines and reliability requirements. The high-level organization of the data center is inside the cloud, with a number of servers running virtual machines to handle all levels of automation. Applications belonging to each automation layer can be grouped to run on the same cloud server(s), enabling better data center organization. A service interface allows users to select, allocate, and manage resources through intelligent decision support.

Advanced functions, such as security and message scheduling, have a dedicated, replicated gateway server.

WHY IT IS BETTER

Moving most of an automation system’s computing and communication infrastructure into the cloud makes it easier, faster, and significantly less costly for users to deploy, maintain, and upgrade their system’s infrastructure and its applications. Cloud-based service eliminates the need to purchase and maintain complex servers and helps reduce on-site labor, which is particularly beneficial for remote facilities (e.g., solar and wind farms). Running controllers on virtual machines offers greater flexibility as well as cost and time savings compared with real hardware. In addition, this design supports switching to different cloud automation providers, since all virtual machines can be migrated as a group to a new provider.

PATENT PROTECTION

Patent applications for this technology platform have been filed in the United States, Europe, China, Japan, and South Korea (Publication No. WO2014124701A1).