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Improvement of lab productivity and operational efficiency using IoT / M2M

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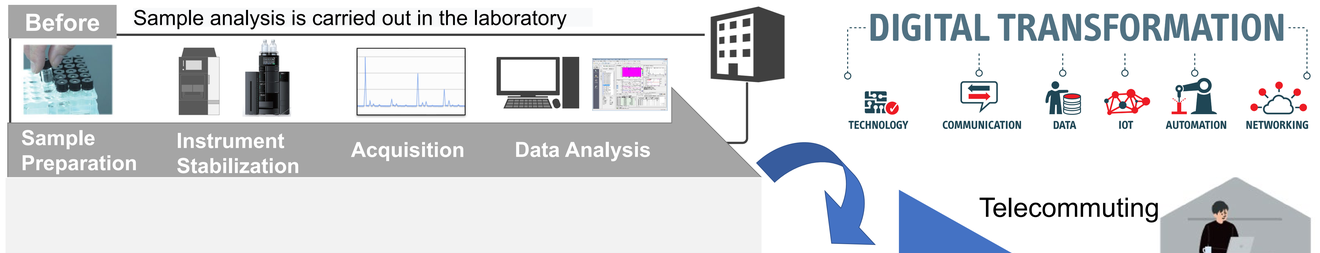
1. Introduction

In the wake of the Coronavirus disaster, pharmaceutical companies as well as manufacturers of food and other daily necessities have been faced with the challenge of maintaining a stable supply of their products. Since these manufacturers cannot stop production, procedures to continue laboratory operations have been discussed and implemented.
Under these circumstances, in order to continue daily analysis work, a new work style has emerged in which operators externally access the analytical data system in a lab through a VPN connection, process data on the server, and create reports.
In order to minimize time in the lab, a system for remotely controlling an instrument or monitoring its operating status using a Web browser built into the instrument or the analytical data system is also utilized. Complicating matters is that analytical instruments require the management of consumables, periodic inspections, and established protocols to implement in the event of failure. However, for the purpose of minimizing infections during the pandemic, on-site staff at many companies has been limited. As a result, there is a risk that the management of the laboratory will be delayed, or that field engineers will have difficulty visiting the site even if the instrument fails.
In response to these issues, M2M (machine-to-machine) technology, which enables machines and information systems to exchange information with each other without human intervention, has been applied, allowing personnel to remotely monitor the operating status of instruments and to manage both the instruments and consumables from an external location. Even if instrument trouble occurs, the downtime can be reduced by performing a preliminary diagnosis remotely and performing appropriate repairs. In this presentation, we will discuss the use of IoT / M2M technology to improve lab productivity and operational efficiency.

2. Digital transformation of laboratory

The Coronavirus disaster has given rise to new ways of working.
Typically, sample preparation, instrument stabilization, acquisition, and data analysis are all performed on-site.
However, there is a demand to improve work efficiency by reducing the time spent in the office and to change the working style so it corresponds to a “New Normal”.
Many people want to telework, but there are issues that need to be solved.
Using digital transformation, such as IoT / AI, it is possible to reform the traditional way of working in the laboratory.



3. Key technologies supporting a "New Normal" in the laboratory

ANALYTICAL INTELLIGENCE

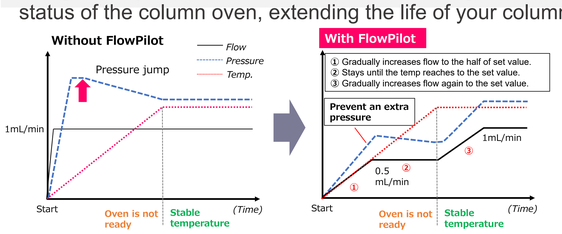
Instrument Stabilization — Automatic and Intelligent

Acquisition — Automatic Recovery and Prevention Trouble

Data Analysis — Access and Operate from Anywhere

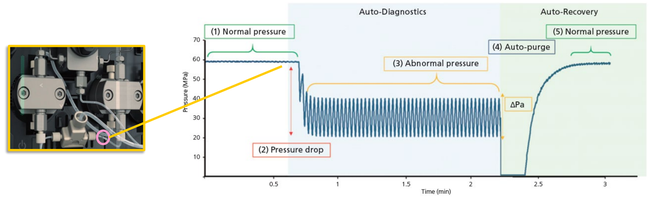
3.1 Advanced start-up to protect columns

UHPLC columns can be damaged by sudden pump starts and extreme gradient changes, especially true with polymeric packings. Smart Flow Control (FlowPilot) increases the flow rate gradually to the method’s set point according to the status of the column oven, extending the life of your columns.



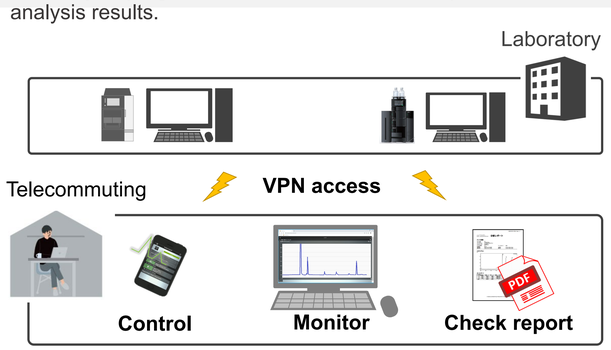
3.3 Reduce downtime by Auto Error Detection and Auto Recovery

The air bubble interfusion causes a drop in the flow rate, resulting in a wrong chromatogram. It rarely happens, making it difficult to predict or manage especially during a long sequence. AI handles it instead of you.



3.4 Remote control by Web / VPN access

For telecommuting, LabSolutions™ Direct technology enables you to remotely monitor, control, and analyze your instruments, and view results using a web browser. Researchers can monitor the analysis progress at home and check the report of the analysis results.



Connect between home and laboratory by Web / VPN access.

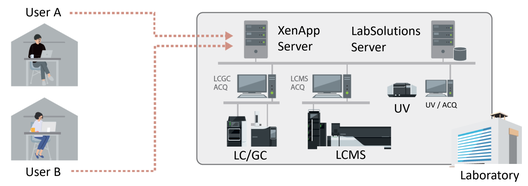
3.5 Remote control / data processing by virtualization technology / VPN access

The network and virtual desktop technologies are the most powerful tools for telecommuting.

Virtual desktop delivers only screen images of applications running on a server to business PCs.

Applications are remotely operated on the client PC. Data compression techniques reduce network load and security risks.

It is possible to perform operations such as instrument control, data analysis, and reporting at any time, and data is centrally managed on the server.



3.2 Prevention of mobile phase shortage by monitoring mobile phase volume

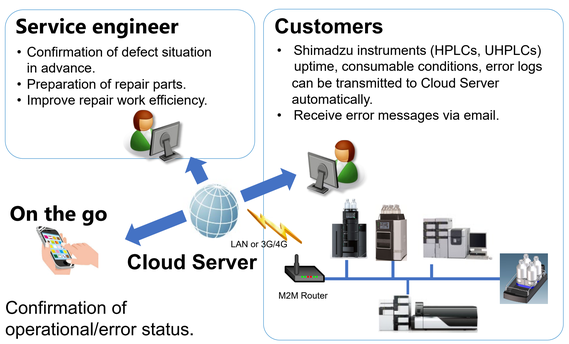
The gravimetry of the mobile phase can be observed through smart devices. An alert is sent in case of a shortage to prevent damaging the column or wasting precious sample.

MPMChecker™

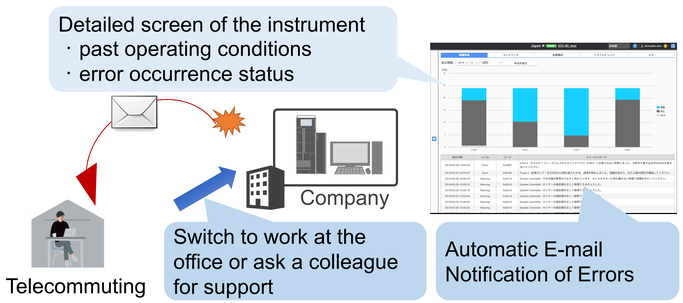
Sends the data to the PC or smart phone

4. Remote maintenance using IoT / M2M

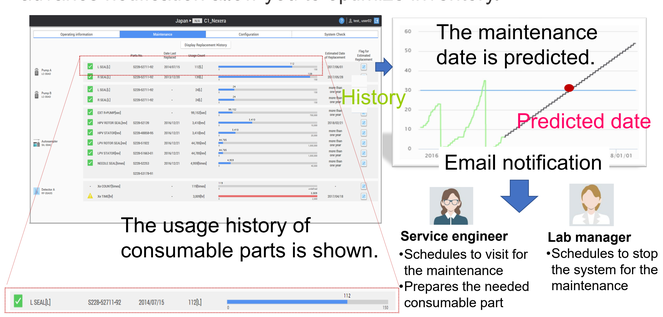
IoT / M2M technology can be utilized to reduce instrument downtime and manage the cost of assets by automatically collecting the system status, conditions of the consumables, and error logs.



Shimadzu Smart Service Net enables you to view the operating status and error information of a single device by clicking on the instrument you want to view from the device list screen. You can also check the operation status and the occurrence of errors, including information history. If an error occurs, an e-mail is sent so that you can ask a colleague at the office for support or switch your schedule to work at the office depending on the situation.



In order to reduce the emergency calls of field engineers due to instrument trouble, the management of consumables and periodic inspections are recommended. Shimadzu Smart Service Net enables scheduled maintenance by predicting when consumables will reach replacement levels based on past usage conditions and notifying you of the date.
In addition, prediction of the consumables’ replacement time and advance notification allow you to optimize inventory.



5. Conclusion

This poster shows how IoT / M2M technology will contribute to the implementation of a new working style in laboratories.

1. **“New Normal” will penetrate even after the Coronavirus disaster**
   "New Normal" has accelerated improving laboratory productivity and operational efficiency.
2. **The key is automation and remote solutions**
   Automated support functions utilizing digital technology enable higher productivity and maximum reliability.
   With the help of Web and virtualization technologies, telecommuting can be implemented for lab work.
3. **IoT / M2M technology supports sustainable laboratory operation**
   IoT / M2M technology allows remotely managing instrument problems and consumables. Even if instrument trouble occurs, the downtime can be reduced.