JAPAN TAPPI JOURNAL
3
March 2025
Vol. 79, No. 3

CONTENTS

Automation Technology

2 A Report of the 48th Automation Technology Seminar
……Process Control and Automation Committee, JAPAN TAPPI

6 Towards the Social Implementation of AI in the Field of Measurement and Control……Tetsuya Tabaru

14 Efforts to Accumulate Logistics Data Using IoT Button Devices……Rei Shiina

19 The Latest Developments in the Wood Chip Vessel Shipping Plan Optimization Solution……Hiroya Ichikawa

23 Case Study：Degitalization of Raw Material Yard
—Degital Data Utilization and Visualizaiton by BI×IoT Technology—……Ren Koike

27 Implementation of Low Cost Commodity IoT Edge Devices to Production Site
……Yamato Hamada, Yasuhiro Tanaka, Noriko Kasai and Makoto Kato

Topics & Information

34 TMEIC Products That Contribute to the Maximization of Production Capacity and the Minimization of Losses……Yuji Ueno

40 DNA UI New Nature of Automation……Kojiro Seki

43 Maintenance Digital Transformations for Stable Operations
—Improving Efficiency and Quality of Maintenance Work—……Takuto Sumiya

47 Introduction of Improving Working Efficiency by Introducing IoT（Internet of Things）Devices……Ryo Shimizu

Research Report

52 Solubility of Cellulose in tetrabutylammonium acetate/dimethylsulfoxide（TBAA/DMSO）Mixed Solvents
—Effect of Water Content on Cellulose Dissolution at Different TBAA/DMSO Mixing Ratios—
……Akari Oki, Yuki Tokunaga, Hiroshi Nonaka, Asuka Yamazaki and Ippei Iwata

Pulp and Paper Mills in Japan（109）

68 Mishima Mill, Daio Paper Corporation

03 Committee report
73 Papyrus

77 Industry News（Domestic and International）
81 List of Patents issued and Laid-open Publication
89 Price list of Domestic Logs and Wood Chips by District
90 Other Monthly Statistics
92 News from the Association

2025 March JAPAN TAPPI JOURNAL
Vol.79, No.3 Abstracts

Towards the Social Implementation of AI in the Field of Measurement and Control

Tetsuya Tabaru
AI Solution Department, Azbil Corporation

Understanding the key points of AI applications and social implementation in measurement and control requires grasping the characteristics of the measurement data involved. Current AI is based on machine learning, and all aspects — computing power, algorithms, and data — are essential. However, it is important to note that measurement data can often be unsuitable for deep learning. First, it is often hard to collect sufficient data required for training. In addition, the lack of sufficient metadata makes it difficult to utilize recent intelligent AI. These limitations imply that AI applications in measurement and control cannot be approached in the same manner as general AI applications. Therefore, recognizing the importance of data quality and selecting appropriate machine learning methods are critical factors for successful AI applications in measurement and control. Deep learning is not always the best choice.

To illustrate these key points more concretely, we will present examples of our AI applications, including technologies for the automatic updating of plant models, machine learning for semiconductor MEMS sensor characteristics, automated image inspection, and new measurement techniques for air conditioning control.

Efforts to accumulate logistics data using IoT button devices

Rei Shiina
Information System Group, Paperboard Business Unit Rengo Co.,Ltd.

The “2024 problem,” which will affect the logistics business due to the 960-hour / year overtime limit for truck drivers, is becoming more serious. Rengo's Yashio Mill, one of the largest paper mills in Japan in terms of paperboard production, is most likely to be affected by this issue. The Yashio Mill is prone to chronic traffic congestion of shipping trucks because the mill site is small in relation to the amount of paperboard produced. In particular, the main cause of traffic congestion is waiting for trucks. The main cause of traffic congestion is trucks waiting for cargo. The occurrence of this waiting is likely to be improved by informing the factory staff in charge of shipping in advance of the arrival time of trucks coming to the factory, and by conducting pre-arrangement of cargo. For this reason, this time we developed an “IoT button device” that notifies the location and approach status of trucks before they enter the factory as a clue to predict the arrival of trucks, thereby reducing the waiting time. Two years have passed since the system was introduced, and the reduction in cargo waiting time has been achieved. This report describes the system configuration of the “IoT button device” and details of its functions.

The Latest Developments in the Wood Chip Vessel Shipping Plan Optimization Solution

Hiroya Ichikawa
ALGO ARTIS CORPORATION

This paper introduces Optium Ship, a logistics optimization solution produced by ALGO ARTIS, utilizing advanced heuristic algorithms to address challenges like reducing idle ship time, fuel consumption, or inventory risks. By automating manual,expertise-dependent processes, it improves efficiency and cost-effectiveness.

At Nippon Paper Industries, it reduced planning time from 600 to 200 hours, cut costs by billions of yen, and lowered greenhouse gas emissions by about 3%. Optium has also achieved success in industries like semiconductor production and energy, delivering outcomes such as a 90% reduction in planning time.

Optium combines speed, precision, and sustainability, making it a transformative solution for modern logistics and operations, enhancing competitiveness and promoting sustainable development.

Case study : Degitalization of raw material yard
-Degital data utilization and visualizaiton by BI × IoT Technology-

Ren Koike
MITANI SANGYO Co., Ltd.

The cost of recovered paper continues to rise due to recent fuel price hikes, which have increased collection and transportation costs. Whereas the rapid increase in demand for recovered paper in Southeast Asia, making it necessary to manage recovered paper inventories to avoid wastage.

Against the backdrop of the above, in this initiative, we together Rengo Co., Ltd. Fukui Division Kanazu Mill (hereinafter "Kanazu Mill") collect data through the Internet of Things (IoT), and use the collected data and Business Intelligence (BI) to digitalize the recovered paper yard (hereinafter "yard"). The goal was to achieve first-in, first-out (FIFO), which further enhances the recyclability of recovered paper through the digitalization of the yard.

To solve the problem, there were challenges in integrating two types of data with different structures, sensor data (unstructured data) and recovered paper inventory data (structured data), but we were able to solve them with the cooperation of the Kanazu Mill.

The introduction of BI increased the visibility of the structured data, clarified the traceability of raw materials, and made it possible to instantly trace which lot of recovered paper was at risk in the event of an emergency. In addition, the ability to visually grasp the condition of recovered paper has prevented the retention of deteriorated recovered paper, and the appropriate delivery of raw materials has improved the yield rate of products, leading to an improvement in product quality.

Implementation of low cost commodity IoT edge devices to production site

Yamato Hamada, Yasuhiro Tanaka, Noriko Kasai, and Makoto Kato
Mitsubishi Paper Mills Limited.

Various manufacturers provide commodity grade IoT edge devices for very low cost nowadays. Due to their limited reliability and robustness, those devices are not widely used for industrial application in Japan. For applications where high reliability is not required, those devices may be an attractive option to realize improved management for minimum cost. As a pilot project in commodity grade IoT edge device utilization, we implemented a hyperthermia risk alert system and a solo worker surveillance system. The IoT edge device firmware was developed using open-source library and only limited part of the firmware had to be developed by ourselves. Commodity grade mesh network system was used as the communication backbone. We chose a general-purpose cloud service, Google Workspace as a server, which receives measured data, generate charts from the data, and sends alert e-mail. The cloud service provider assures >99.9% uptime percentage, which meets our demand required in this kind of purpose. To compensate the reliability lower than industrial sensor system, watchdog timer technique was used. The developed system has been in service more than two years without essential problem. Only by changing sensor device, the hyperthermia risk alert system can be applied to another application including internet based telemetry system.

TMEIC Products that contribute to the Maximization of Production Capacity and the minimization of Losses

Yuji Ueno
TMEIC Corp

In recent years, the social situation has been constantly changing due to societal demands for a sustainable society and the increase in various costs. To respond to such changes, it is necessary for each company to improve the allocation of resources (people / materials / finances / information / time / energy) that they own or use.

Furthermore, each factory must promote further digitalization through the use of AI and IoT technologies, maximizing production capacity and minimizing losses from the current state of visibility/transparency. This paper introduces systems that support the production site with TMEIC products, assisting from three perspectives: predictive and preventive maintenance, prevention of recurring troubles, and optimization of equipment operation.

DNA UI　New Nature of Automation

Kojiro Seki
Valmet K.K

Valmet DNA's new User Interface (DNA UI) represents a significant advancement in the automation of the pulp and paper industry. DNA UI transforms traditional control rooms into "control spaces," enhancing operator efficiency and productivity. This web-based interface allows users to access personalized information anytime and anywhere, adapting to various roles and operational scenarios.

Key features of DNA UI include customized user profiles, intuitive user experience, and robust cybersecurity measures. It supports mobile and cloud access, promoting flexible and collaborative work environments. The interface's design facilitates rapid information retrieval and task execution, improving overall operational effectiveness.

Security is a cornerstone of DNA UI, incorporating extensive threat modeling, secure design and implementation practices, and continuous security updates. This ensures that the automation network and host computers are protected from threats, maintaining system reliability.

Valmet DNA UI continues to evolve, aiming to meet the increasing demands of modern industrial automation. By providing real-time access to critical data, the system helps optimize production processes, ensuring higher efficiency and competitiveness in the industry. The ability to customize display settings, language preferences, and theme selections further enhances user satisfaction and operational efficiency.

This paper discusses the development and implementation of DNA UI, addressing customer challenges, enhancing user experience, ensuring security, and improving operational efficiency. DNA UI is poised to set a new standard in industrial automation, driving productivity and innovation in the pulp and paper sector. With its advanced features and user-centric design, DNA UI offers a transformative solution that meets the evolving needs of the industry.

Maintenance Digital Transformations for Stable Operations
-Improving Efficiency and Quality of Maintenance Work-

Takuto Sumiya
Yokogawa Solution Service Corporation

We have developed compact wireless sensors, the Sushi Sensor series, for maintenance. The XS770A integrated wireless vibration sensor, which is robustly designed to be used for digital transformations. This battery-driven sensor can monitor the vibration and surface temperature of manufacturing facilities for a long period, significantly reduces the cost of monitoring. This paper describes the feasibility of condition-based maintenance (CBM) in plants. We believe Sushi Sensor achieves high standard of monitoring and data analysis for maintenance work in pulp and paper plants.

Introduction of improving Working Efficiency by Introducing IoT (Internet of Things)　Devices.

Ryo Shimizu
Tomakomai Mill, Oji Paper Co.Ltd

Oji Paper, Tomakomai mill is producing the largest amount of pulp and paper among all of Oji HD mills in Japan. There are seven paper machines that produce some types of paper, including newsprint, coated paper, carton board, and special carton board. Due to a shortage of skilled maintenance technicians and the goal of improving working efficiency, the author, who works as an Electrical and Instrumentation section manager, is currently researching how to utilize IoT tools to reduce the manpower required by the mill. In this article, we describe how a plant monitoring system is utilized with 2 examples of IoT for improving working efficiency.

Solubility of Cellulose in tetrabutylammonium acetate / dimethylsulfoxide (TBAA/DMSO) Mixed Solvents
-Effect of water content on cellulose dissolution at different TBAA/DMSO mixing ratios-

Akari Oki, Yuki Tokunaga and Hiroshi Nonaka
Graduate School of Bioresources, Mie University, Japan
Asuka Yamazaki and Ippei Iwata
Futamura Chemical Co., Ltd.

Tetrabutylammonium acetate (TBAA) / dimethyl sulfoxide (DMSO) mixed solvent dissolves cellulose in a short time under mild temperature conditions and can be reused. Cellulose regeneration process using this solvent (Ogaki method) is expected to be an alternative method to the viscose method. In this study, we aimed to clarify the effect of water content in the solvent on the solubility of cellulose in TBAA/DMSO mixtures. Sample solvents were prepared by adding approximately 1, 5, and 9% water to TBAA/DMSO mixed solvents with various TBAA ratios (20-50%). The β value of the Kamlet-Taft parameter, which is considered to be closely related to cellulose dissolution, was larger for higher TBAA ratios and lower water content. The cellulose sample was tested for dissolution in these solvents, and the best solubility was observed in mixtures with a TBAA ratio of 20~30% with 1% water added, while solubility was low at TBAA ratios of 40 and 50% despite the high β value. When 5% water was added to a solvent with a TBAA ratio of 20%, the solubility of cellulose was significantly reduced and not even 1% of cellulose could be dissolved, whereas 3% of cellulose could be completely dissolved with a TBAA ratio of 30%, indicating that the latter composition of the solvent has a high tolerance for water contamination. This is advantageous in terms of easier control of the moisture content of the raw pulp and solvent. Dissolution of cellulose in TBAA/DMSO mixed solvents in this study was more favorable in solvents with β values greater than 1 and lower viscosity. In solvents with a TBAA ratio of 20-30%, the addition of water did not affect the viscosity, but it decreased the β value and thereby the solubility of the cellulose. On the other hand, the solubility of cellulose in solvents with high TBAA ratio was not large due to their high viscosity, but it was assumed that the addition of water has the effect of decreasing viscosity, contributing to the increase in solubility.