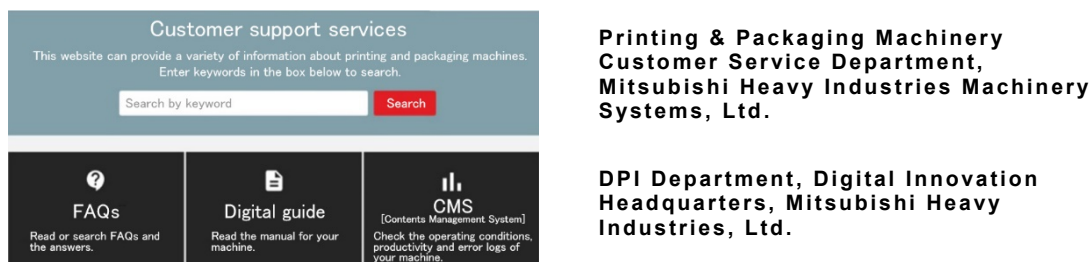


Development of "CUSTOMER PORTAL" for Printing & Packaging Machines



Mitsubishi Heavy Industries, Ltd. (MHI) and Mitsubishi Heavy Industries Machinery Systems, Ltd. (MHI-MS) jointly developed a customer portal that works as a liaison for online customer services regarding packaging machines and web offset presses. The portal was developed because, given the current labor shortage situation, we considered it essential to establish a line of digital communication as an indispensable means of enhancing the work efficiency on both customer and our sides. Technically speaking, in order to keep improving our services through the customer portal in a timely manner in accordance with the needs of customers, a cloud-based serverless architecture was adopted because of its relative ease in handling changes in the required specifications and low maintenance, whereby the agility of the system is enhanced. The customer portal has been on trial in a score of more than twenty our customer companies since the second half of 2021. In 2022, the introduction will be promoted to more customers. As a service provider that customers can always rely on, we will make this portal the very “first door to knock” when customers need to make any inquiries about machine operation, maintenance and repair, and thus improve customer satisfaction.

1. Purpose of development

The recent advancement and spread applications of IoT technology have made it more probable to be able to remotely collect various types of data that were impossible to obtain without direct inspection of an actual machine. Therefore, having so far depended on the intuition and experience of skilled technicians on-site, machine maintenance is getting more likely to be performed based on persuasive maintenance proposals using remote data. As the use of digital communication tools such as SNS and online meetings become common, people feel less hesitant in communicating digitally. For these reasons, we have developed a “customer portal” in order to not only streamline the time-consuming and labor-intensive processes of analog maintenance/inspection and communication through digitalization, but also enable customers to have more means of contact so that they can feel easily reachable to services of MHI-MS. This report presents the customer portal in terms of its functionality, technological features, and current availability to the public, as well as future prospect.

2. Pain points

In developing the portal, we first conducted hearings with the customers and service centers to extract pain points (i.e., the problems they experienced) in relation to our services. The results indicate that, in the case of the conventional analog-based services, there were many cases in which it took time to get through to the service center for inquiries, or the status of the inquiry that had been made was unclear. We designed the functionalities of the "customer portal" so that these pain points can be solved.

3. Functionality of the customer portal

As shown in **Figure 1**, the main functionality of the customer portal is six (including some optional functions). Only the users who have registered to the portal have access authority. Customer access is restricted on a factory-by-factory basis, and the accessible data is limited to those related to the user’s factory. In addition to the major functions described below, the portal

provides the site search functionality and receives/shows the newsletters and announcements from MHI-MS.

3.1 Functionality 1: inquiry management – to make it easier for customers to request

Conventionally, inquiries are made mainly face-to-face, or by telephone or email. Now that the portal is available as the “fourth means of contact” for inquiries, customers can ask technical questions including adjustments, quality and malfunctions through the portal (except for requests for emergency response) or get quotes for parts, maintenance, replacement and such. Each inquiry is managed by creating a ticket for it, and the work progress can be notified by status information and email.

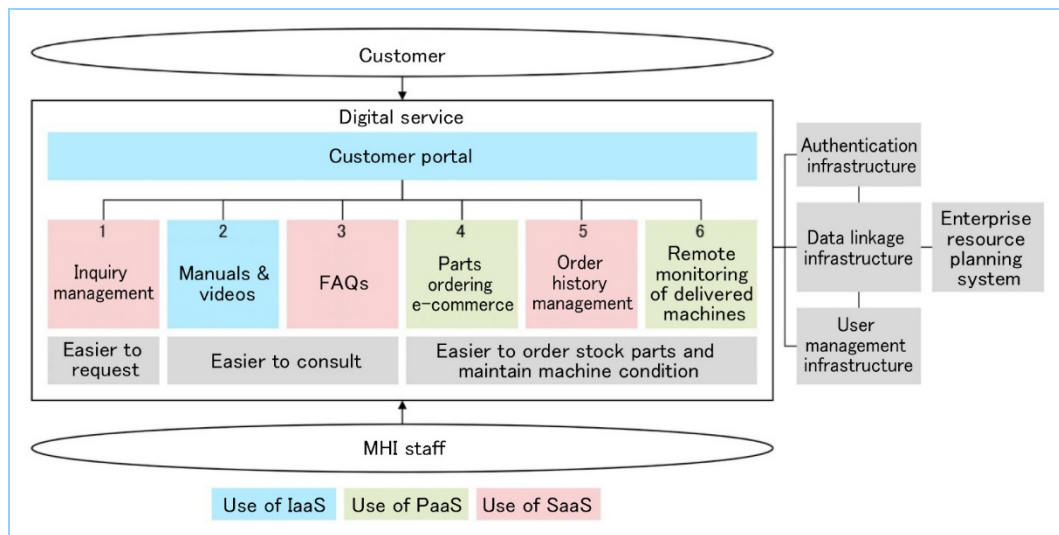


Figure 1 Conceptual diagram of system structure

3.2 Functionality 2: manuals and videos – to make it easier for customers to consult

This enables customers to read the manuals for their machine models. As the data are digital, it is possible to search by word, which realizes quick access to the relevant sections. Some work procedures are presented by video.

3.3 Functionality 3: FAQs – to make it easier for customers to consult

This makes it possible to search and refer to the questions frequently asked by customers and their answers. The FAQ list includes a good amount of useful information related to daily troubleshooting and maintenance such as adjustments, handling of problems, product quality information, and maintenance procedures. The goal is to help shorten the time required for maintenance work by improving the availability of information.

3.4 Functionality 4: parts ordering e-commerce – to make it easier for customers to order stock parts and maintain machine conditions

This enables customers to select parts online and add to the cart, whereby quotes can be obtained/printed and orders can be placed without restrictions of office hours.

3.5 Functionality 5: order history management – to make it easier for customers to order stock parts and maintain machine conditions

This enables customers to check the details of past maintenance work and parts purchases. The referable information includes the date of order placement, part name/number, quantity, order number in MHI, and work description/report.

3.6 Functionality 6: Remote monitoring of delivered machines – to make it easier for customers to order stock parts and maintain machine conditions

This makes it possible to show, aggregate and analyze the data obtained from the machines of customers, thereby visualizing the operating conditions, productivity, error logs, etc. Specifically, as shown in Figure 2, this functionality can offer the following seven tools:

(1) Production dashboard

Able to check the data of the machine such as past production records and productivity.

- (2) Condition dashboard
Able to check and analyze the occurrence status of machine alarms.
- (3) List of order information
Able to check the list of past production orders.
- (4) Comparison of production records
Able to show/compare the change in productivity and production records of each machine in time series.
- (5) Past measurement data
Able to show the charts, side by side, regarding the temporal data of machine and production.
- (6) Analysis of the cause of shutdown
Able to show the analysis results of the cause of shutdown.
- (7) Real-time display
Able to show the charts of raw data such as motor torque in real time.

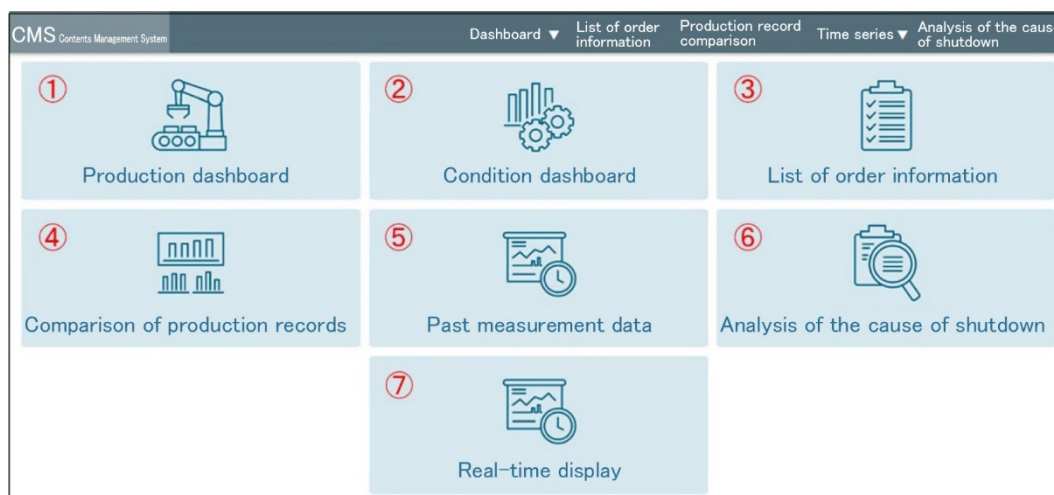


Figure 2 Remote monitoring of delivered machines

4. Technological features of the customer portal

In order to keep improving our services through the customer portal in a timely manner in accordance with the needs of customers, a cloud-based serverless architecture has been adopted because of its relative ease in handling changes in the required specifications and low maintenance, thereby enhancing the agility of the system. As shown in the system structure conceptual diagram (Figure 1), the portal is connected to the security critical infrastructures for user management and authentication, as well as the data linkage infrastructure through which our enterprise resource planning system is connected to the portal. Depending on the requirements of each functionality, IaaS (Infrastructure as a Service), PaaS (Platform as a Service) or SaaS (Software as a Service) is selected for use. By making active use of management services such as SaaS and PaaS, we accelerate the development of applications with better usability and streamline the operation with governance. Furthermore, the appropriate utilization of managed services for user authentication makes it possible to employ the latest security technologies. To enhance the quality through continuous improvement of digital services, we work with our in-house digitalization team that develops and manages digital services without outsourcing. In this way, we ready ourselves to make prompt improvements in the system in response to various requests from customers.

5. Current availability of customer portal

In the second half of 2021, we looked for customers who were willing to help with the pilot trial of the customer portal at our service centers nationwide and implemented the portal for a score of more than twenty companies. After about six months of trial, a customer questionnaire survey was conducted through the portal. Some reacted favorably with comments such as “the functions such as past history and FAQs have improved the usability”, “the web-based parts ordering system has smoothed the procedure”, “the time required is considerably shorter than telephone/email

inquiries”, ” checking past history can eliminate the need to search for previously purchased parts and reducing missing parts orders for consumables” and “work in common even if the estimator and orderer are different, make easier management when operating with multiple parsons”. However, others made requests for further improvement of usability. The portal site is still in need of continuous improvement in this regard.

6. Future prospect

In 2022, while making such necessary improvements, we will promote the introduction of the portal to other customers as well and expand the range of parts that can be ordered through the portal.

As the customer portal presented in this report has just come into use by customers, we consider it necessary to improve continuously in accordance with the needs of customers. Looking forward, we will also actively incorporate technologies such as AI and help customers to shorten the lead time needed for parts procurement and improve the efficiency of maintenance work, while enhancing the quality (accuracy) of our services. The portal will be therefore allowed to function, in a sense, like a concierge assisting customers with various requests, which we believe can be of help for further development of their businesses.