The Importance of Personal Identification in the Fields of Next-Generation Fabrication (Monozukuri)

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Abstract

Recently, the fields of "monozukuri", or fabrication of goods, have seriously called into question whether or not the work is being executed correctly as defined in law and in the agreements made with customers. In addition, as the fluidity of human resources is increasing, as seen in the proposed increase in the number of foreign workers, it has become necessary to manage workers appropriately in order to improve the quality of their work by identifying them individually.

This paper introduces the personal identification of individual field workers, based on the facial recognition of individuals and of the "NEC DX Factory Co-creation Space," that are implementing the next-generation fabrication process. Actual cases of its use and the importance of personal identification in the field of "monozukuri" are also discussed.

Keywords

value chain innovation, smart factory, manufacturing industry, factory, IoT, AI

1. Introduction

The recent advancement of AI and the expansion of IoT have given birth to an increase in the number of new technologies and services. These are also expected to change the fabrication methods of the manufacturing industries.

On the other hand, while the reduced working population and extended working hours are causing social problems, the automation using facilities and robotics are advancing in the fields of fabrication. However, these invariably affect the kinds of work that is more effective when performed by manual labor, such as the high-mix/low-volume production required for mass customization. Consequently it is expected that the next-generation fabrication process will be started from the collaborative work of the facilities, robots and humans. The work situation will then be reproduced virtually in digital space and the results obtained thereby will be fed back to the real world (**Fig. 1**).

Considering the recent frequent occurrences of issues such as inspections made by unqualified personnel and manipulation of the results, enterprises need to build confidence by observing compliance in addition to fabricating high-quality products.

In this paper, the following subjects are discussed; section 2 considers the importance of personal identification in the fields of fabrication, section 3 gives an outline of the "NEC DX Factory Co-creation Space", which is an implementation of next-generation fabrication, and sections 4 and 5 introduce the identification of individual workers using "Face Recognition Impersonation Prevention Solution," and also the way in which it is applied

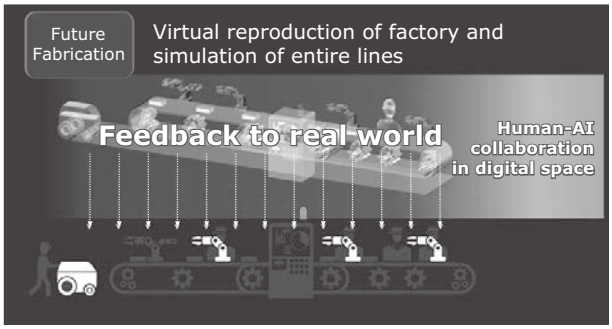

Fig. 1 Fabrication of the future.

in the "NEC DX Factory Co-creation Space" is also discussed.

2. The Importance of Personal Identification in the Fields of Fabrication

In the Japanese manufacturing industry grave social issues that are resulting from various deceptive acts are being revealed one after another. These include allowing the production and inspection operations to be performed by unqualified personnel and the falsification of inspection results. In the future fabrication of goods it will become an important responsibility for each enterprise to observe compliance and retain satisfactory evidence that production has been carried out properly, in addition to providing high-quality product manufacturing. Since authentications based on the user ID and password leave some room for allowing the borrowing and lending of IDs, a mechanism that can reliably identify the persons that are actually working on a job becomes necessary.

As the shift from mass-production to high-mix/low-volume production is accelerating in order to meet the market diversification, the work procedures for manufacturing are becoming more complicated. Moreover, the increase in the numbers of immigrant and non-regular workers is increasing the fluidity of field worker employment. In such an environment, it is expected that fabrication by maintaining a certain level of QCD (Quality, Cost, Delivery) will be more difficult to achieve in the future. It is expected that accurate work navigation according to worker skills by identifying them individually will be an important factor in dealing with these issues.

3. NEC DX Factory Co-creation Space

NEC has established the "NEC DX Factory Co-creation Space" at the Tamagawa Plant (Kawasaki City, Kanagawa, Japan). This is the site where the next-generation fabrication is being implemented. The advanced technologies and products of NEC and its partner enterprises/organizations are assembled here and the solutions merging NEC's innovative fabrication expertise are collected. This is the place where our visitors can experience the world of future fabrication realized by digital transformation.

The production facilities at the NEC DX Factory Co-creation Space assuming the manufacture of small electronic devices are composed of four processes. These include the parts replenishment, processing/embedding, assembly and inspection. Automated guide vehicles (AGV) are working in the complementary parts replenishment and finished product carrying operations (**Fig. 2**). The assembly process is carried out by the human labor. Visitors can see and feel the future of fabrication materialized under the collaboration of state-of-the-art facilities, robots and humans.

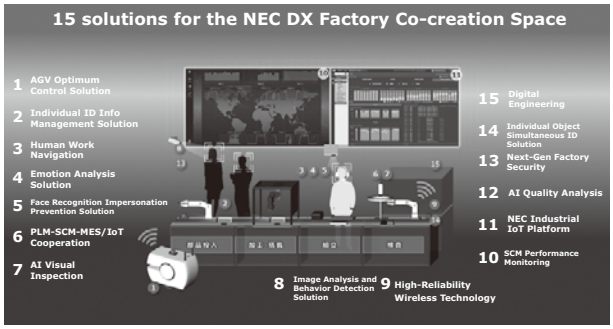

Fig. 2 Solutions applied at the NEC DX Factory.

In the production facilities, 15 solutions making use of the AI and IoT as shown in Fig. 2 are incorporated in supporting the solution of issues in the fields of fabrication. More solutions are planned to be added in the future.

4. Face Recognition Impersonation Prevention Solution

For the purpose of personal identification in the fields of fabrication, the NEC DX Factory Co-creation Space incorporates the Face Recognition Impersonation Prevention Solution.

As shown in **Fig. 3**, this solution performs biometric personal authentication by collating the facial data stored in the QR code or on the IC card with the face image shot with a camera.

This solution exhibits the following features and advantages when it is applied in a fabrication field.

(1) Smart device operation enabling anywhere authentication
Diffusion of smart devices in the fields of fabrication makes the addition of devices unnecessary or lowers their introduction barriers.

(2) No need for a database or for network building
The introduction and modification are possible under the leadership of the field workers, without relying on the IT department.

(3) Biometric authentication without keeping personal information at terminals
The dissemination of IoT has made it necessary to handle personal information including biometrics more cautiously than ever. In order to ensure security, it is quite effective not to leave biometric infor-

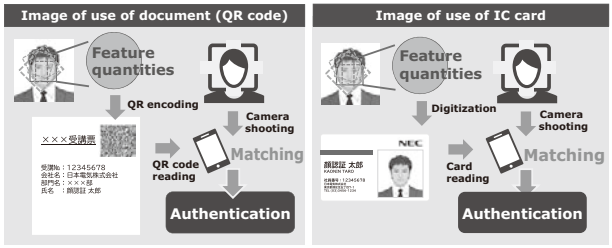

Fig. 3 Outline of Face Recognition Impersonation Prevention Solution.

mation in the servers or in the terminal equipment installed on the lines.

5. At the NEC DX Factory Co-creation Space

Employing the Face Recognition Impersonation Prevention Solution at the entrances of working areas in the NEC DX Factory Co-creation Space makes it possible to restrict entry into the working areas to permitted workers only. The setup work such as that for the parts supply may also be permitted only to skilled workers.

The IoT in the fabrication is required to improve the QCD by integrated storage and the use of the data not only on the facilities but also on goods and persons. However, it is regarded as being difficult to collect personal work data accurately. This issue is solved by combining the Face Recognition Impersonation Prevention Solution with other solutions to achieve highly reliable collections/analyses of personal work data.

In the assembly process of the NEC DX Factory Co-creation Space, the reliability and productivity of work are improved by providing easily-understandable work navigation based on voice instruction and projection mapping (**Photo**). The voice recognition technology is also applied to convert the work results spoken by each worker into data and to enable detailed work achievement registration per work item.

The Face Recognition Impersonation Prevention Solution is also applied to the assembly process so that authentication before work can ensure that the work is conducted by permitted workers only and that the navigation can be varied according to the skill of each worker in order to improve both the reliability and productivity of the work. Highly skilled workers are given simple voice instructions for the work while the novice workers are given work instructions that combine detailed voice navigation and projection mapping.

The work data of individuals that has been collected as described above can be used in support of the accurate work analysis of each worker (**Fig. 4**).

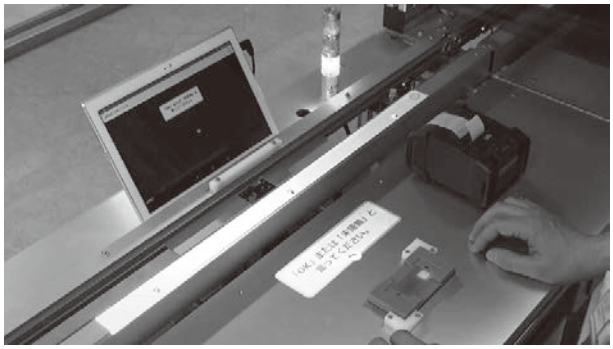

Photo Work instructions by projection mapping.

Fig. 4 Example of personal work data analysis.

Fig. 5 Analysis display of Emotion Analysis Solution.

When the Emotion Analysis Solution that analyzes human emotions using the data collected from wristband-type wearable devices is combined, it is also possible to analyze the emotion of each worker in each work event and to use the obtained results to contribute to improvement of the work (**Fig. 5**).

6. Conclusion

The NEC DX Factory Co-creation Space will combine facial recognition and various other solutions to implement the next-generation fabrication mode, in which humans, facilities and robots will collaborate.

Personal identification based on biometric information will be more important in the future in improving the QCD for a society with a serious labor scarcity, while at the same time building confidential relationships with customers by observing compliance.

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