Construction Site Personnel Entrance/Exit Management Service Based on Face Recognition and Location Info

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Abstract

In a construction site, the field supervisor manages the site and personnel with skills in various expert techniques are organized to advance the work. As the required techniques vary depending on the operation process, personnel belonging to several companies enter and exit from the site during the construction period. Since some of the field operations are dangerous, the supervisor must secure the safety of each worker by identifying all of the workers on the site and managing their data. NEC has implemented a service that performs these management procedures with face recognition-based personal identification and the location information without installing additional equipment. Thanks to the capability of easily obtaining the entrance/exit data, this service can check the credentials of each worker and output the results of entrance/exit data calculations. This paper introduces the features of this service.

Keywords

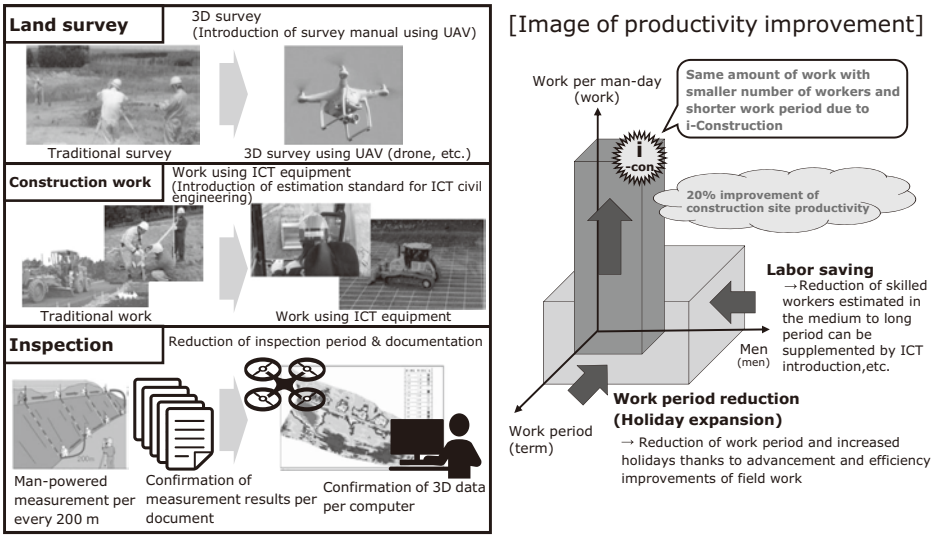
face recognition, GPS, location information, construction site, site personnel payment management

1. Introduction

Shortage of labor has become an important recent issue in the construction industry. For example, for the age composition of operative craftworkers, among the 3.2 million skilled workers in 2015, 1.1 million will retire for the reason of age and other causes in 2025. The population of productive age from 15 to 64 years that was 78.83 million in 2015 is estimated to reduce significantly to 44.18 million in 2060, which means that it will be hard to secure, not only the skilled workers, but also the construction engineers who will manage the work and develop new technologies. To deal with these issues, efforts are being accelerated in the construction sites in order to improve the productivity. Contrastingly to the consistent improvement of productivity in manufacturing industry, the productivity in the construction industry has been stagnating since the latter half of the 1990's, until it has dropped from a position almost equivalent to that of the manufacturing industry in the past to about a half of that (**Fig. 1**).

Considering the more serious labor shortages that are almost sure to come in the near future, the need for productivity improvement has become an urgent issue. This is the reason that both the Japanese government and the private sector are currently enhancing the productivity improvement measures.

Fig. 1 Comparison of value-added labor productivity.



Source: Situation of i-Construction and Future Use

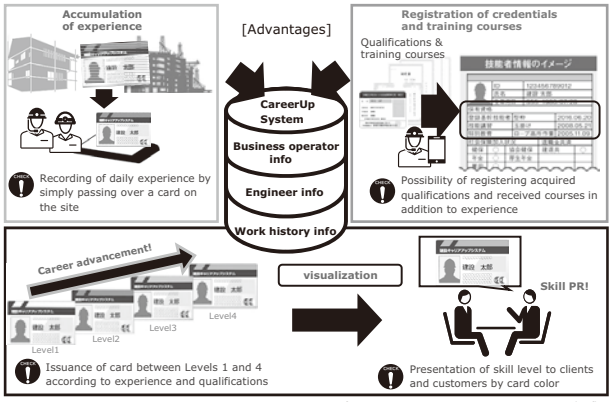
Fig. 2 Productivity improvement in the construction industry.

2. Utilization of IT/ICT in the Construction Industry

Utilization of IT/ICT is essential for improving productivity in the construction industry. Although being one of the biggest industries in Japan, the construction industry has been slow to use IT/ICT compared to other businesses. However, this also means that because the introduction of IT/ICT has been delayed, the construction industry has correspondingly diverse margins for efficiency improvement once they are introduced. The recent acceleration of the use of IT/ICT by the industry has two backgrounds; the first is the launch of the "i-Construction" policy by the Ministry of Land, Infrastructure, Transport and Tourism in November 2015 to promote the productivity improvement of the construction industry, particularly the civil engineering sector. The concept of "i-Construction" aims at a consistent introduction of IT/ICT in the process of construction projects in order to significantly improve the efficiency of the construction industry production activities (**Fig. 2**).

The second background is the promotion of the "Construction Careerup System" (**Fig. 3**) by the said ministry. This system has been prepared with the aim of improving the working environment of skilled workers and is scheduled to start on April 2019. Specifically, the system saves the field work histories and the credentials possessed by each skilled worker according to the combined rules of the industry, so as to attempt improvement of the treatment of skilled workers and to develop their skills.

Backed by the acceleration of the introduction of IT/ICT in the construction industry, NEC has started a co-creation of the WG of NUA construction users` association named the "Field Site Productivity Improvement Subcommittee" in order to support services that would contribute to productivity improvements at construction sites. Among them, NEC has selected a service with which the seeds match the needs of the field best and for which early provision is possible. It was released in 2018 as the face recognition-based construction site entrance/exit management service (site personnel payment management service).



Source: Extract from CCUS Construction Careerup System leaflet

Fig. 3 Outline of Construction CareerUp System.

3. Face Recognition-Based Construction Site Entrance/Exit Management Service

The factors that have inhibited the introduction of IT/

ICT at construction sites result from the special environments of the construction industry, such as: 1) "single-item build-to-order" – with which different structures should be built every time according to the request from the order; 2) "outdoor production" – where it is hard to maintain the environment at a constant level; 3) "fixed term characteristics of construction projects" – due to the differences in scale and environment between sites, the assets obtained at a site are hard to transfer to another one and tend to be used only for a short period. Considering these issues, the Face Recognition-Based Construction Site Entrance/Exit Management Service introduced herein makes possible the entrance/exit management of workers by installing an app in a smart device, such as a smartphone or tablet and without installing equipment on the site.

As the application to the service can be made on a per-site basis, the decision of introduction can be made according to the scale and characteristics of each site. In this way, this service can be started immediately according to the situation in the field and it can be introduced also in a site where various people gather and the workers are changed according to each process.

4. Features of Face Recognition-Based Construction Site Entrance/Exit Management Service

The Face Recognition-Based Construction Site Entrance/Exit Management service has the following three features.

(1) Impersonation prevention by face recognition and location info

The entrance and exit of workers are recorded according to the entering of a site specified by each worker at the time of entrance. When the NeoFace Cloud GPS Linked Service cloud service is used, accurate personal identification based on face recognition is naturally possible as the location information and time of day are also recorded at the same time. As the location information is preset in the site information, it is possible to confirm that entrance is not made at an illegal location by checking the location information in the entrance/exit record and the site information. Combining these items of information enables the prevention of impersonation.

(2) Anytime, anywhere checking of possessed credentials information

The entering workers perform the work scheduled for them but, in a site with a large number of workers that involves a frequent change of labor, it becomes hard to identify the accurate qualification information of each worker engaged in the work. There has been no clear on-site checking method and checking has had to be done ad hock, by verbal checking or making an inquiry to the cooperative company managing each worker. However, this service makes it possible to check the face information and qualification information on a tablet terminal so the supervisor can check the information of workers at the desired timings.

(3) Linkage with the Construction CareerUp System

This service is capable of linkage with the Construction CareerUp System, which is one of the national policies as described in section 2. With the linkage, the affiliation and qualification information of workers can be obtained from the Construction CareerUp System and the recorded entrance/exit can be sent to the Construction CareerUp System as the work history.

5. Effects of Introduction

Introduction of the service above brings about the following three effects (**Fig. 4**).

(1) Entrance/exit management cost reduction

When information on the workers approved to enter the site is registered in advance, the personal identification can be completed at the same time as the entrance or exit. As a result, the entered and exited persons can be checked at a glance by referring to the entrance/exit list on a tablet or computer, so the trouble of entrance/exit checking can be reduced. The recorded entrance/exit data can be output with CSV files as daily data per worker or per cooperating company, so the labor in compiling the monthly report or the documents for use in payments to the cooperating companies at the end of the month can also be reduced. Also, with the construction sites that used to attempt accurate worker management by distributing cards, etc., there have been various issues such as the management of the cards to be distributed at each site, measures to be taken for

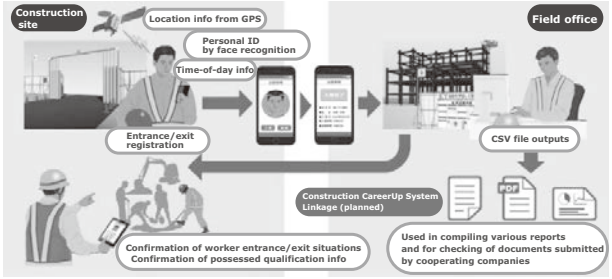


Fig. 4 Image of operation of the service.

workers who forget their cards, the risk of card losses and the cost of reissuance. The effects of these issues can also be reduced by adopting biometric authentication.

(2) Accurate entrance/exit management

In a site where the workers are changed per work process, some workers enter it newly and some exit after completing their work. In such a situation, accurate entrance/exist management and checking are indispensable for safety at a hazardous site. In fact, however, as routine checks on the site are very troublesome, personal identification including the qualification checks are not always performed every day and these are often entrusted to the cooperating company. Because the service introduced herein is capable of accurate entrance/exit management with little trouble, it allows the supervisor to secure the site safety under his or her own control and its accurate entrance/exit records can help the payment of labor charges and the reduction of social insurance premiums.

(3) Contribution to worker safety management

The possibility of an immediate confirmation of the qualification information facilitates checking if workers with appropriate qualifications are allocated to hazardous work in the field. Should a disaster occur, the possibility of knowing the situation of persons entered in the site can contribute to securing their safety.

6. Conclusion

Now that the serious labor shortage in the construction industry has become an important issue, it is essential to promote labor saving at all sites, even when considering the special labor-intensive environment of the industry, where labor saving has always been regarded as being difficult. NEC believes that the construction sites do have many aspects where labor saving is possible by applying technical innovations brought about by IT/ICT.

NEC positions the Face Recognition-Based Construction Site Entrance/Exit Service introduced here as the first of the services for field labor saving purposes that will be released in the future. The "Field Site Productivity Improvement Subcommittee" started in FY2017 is still continuing its work in FY2018, and NEC is planning to provide services to deal with construction site issues by combining the latest ICT, experiences and the opinions from the field.

For the future, too, NEC is determined to promote labor saving to help reduce the labor shortage in the construction industry by solving these issues.

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* i-Construction is a trademark or a registered trademark of National Institute for Land and Infrastructure Management.
* Construction Careerup System is a trademark or a registered trademark of KENSETSUGYO SHINKO KIKIN (Construction Industry Promotion Fund) (trademark pending).
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