The data reading of all RFID tags is performed with forklift trucks in a batch processing manner. Toughpad tablet devices are used to operate an innovative system that serves a pioneering role in managing individual pallets.

Japan Pallet Rental Corporation (JPR) is taking an initiative in the industry to provide a pallet rental service that meets the Japanese Industrial Standards (JIS), with the goal of optimizing the efficiency of logistics. The company has the largest market share and sales volume with regard to its rental pallet business, and also owns the largest number of rental pallets in the industry. Taking advantage of its expertise in the management of logistics containers, JPR is involved in providing information services as well. In recent years, it has made efforts to harness RFID-tagged pallets to promote the improvement of logistics efficiency based on the Internet of Things. As part of such efforts, JPR has developed an innovative "Tag Reading Fork*" system that is designed to read the data of RFID (Radio Frequency Identification) tags attached to pallets with forklifts. A rugged 7-inch Toughpad FZ-M1 tablet has been used to operate and control this system, and a rugged 10.1-inch Toughpad FZ-G1 tablet has been used to operate and control a system that inspects the quality of RFID tags.

* Tag Reading Fork is the registered trademark of Japan Pallet Rental Corporation.

RFID Department
Leader
Masakazu Sato

RFID Department
Chief Specialist
Yuji Uchida

(Above image)The data of RFID tags attached to the pallets is read and uploaded via FZ-M1 to the data server while the pallets are placed on the forklift forks and are lifted and moved with the forklift.
(Left image)FZ-M1 is installed above and to the right of the driver's seat of the forklift. The tablet device is designed so that the operator can operate it with gloves on. Mr. Sato said, "FZ-M1 has a mode whereby the user can operate the device with gloves on. During winter in Hokkaido, this mode is helpful to us because we often work in a place where it is cold enough to wear gloves."

Background to introduction

JPR has succeeded in managing the data of each one of approximately 300,000 rental pallets that are put into/taken out of storage per day.
Toughpad tablets are the only devices that fully satisfy the needs of the company, which is aiming to control and operate a new system based on forklifts.

JPR has adopted the Internet of Things into their business for the long term. The company currently owns about 6 million plastic pallets, more than 90 percent of which have RFID tags attached. It has established the RFID Department so as to get the most out of such pallets with RFID tags and apply them as a key means for managing pallet information. As part of this project, the company initiated its efforts toward achieving the

Why Toughpad FZ-M1 and FZ-G1 were chosen

Point 1	Point 2	Point 3
Dust- and water-resistant design, which enables the tablet devices to be used in an outdoor environment	Mode whereby the users can operate the devices with gloves on	High-capacity batteries that are powerful enough to continuously run the devices for a longer time

reading of the data of each RFID-tagged pallet as precisely and efficiently as possible to finely control the operation of product management in the depots directly operated by JPR. Under the company's initial plan, the data of RFID tags attached to individual rental pallets were read each time they were rented and returned, and the obtained data was stored in a database. This plan was intended to realize visual control of the current status of rental pallets on a real-time basis. As each depot had a different operational condition, it was difficult to establish a system that met the following criteria: The system should be designed to surely read all the RFID tag data of a large number of pallets rented and returned every day; it would never significantly interrupt any operations; and it could be commonly used by all of JPR's logistics bases.

Mr. Sato told us that they tried to install gate-type data readers to make sure that all pallets were passed through the gates. However, the operation efficiency of the readers was lower at some depots because they were subject to some constraints in the aspects of workflow and traffic lines for people and cargo. Thus, the gate readers were not suitable to be introduced in all the logistics bases. JPR sought an alternative to the gate readers, and finally devised an idea to apply forklifts, which were used in all of its logistics bases, as data readers. The company has developed a "Tag Reading Fork" system, one of the most innovative technologies in the industry. The Tag Reading Fork enables the reading of the data of RFID-tagged pallets placed on forklift forks. In conjunction with the development of the system, JPR started to choose a tablet device that could be mounted on forklifts. According to Mr. Uchida, JPR made a snap decision to introduce Toughpad tablet devices as soon as it began to select a device.

"Toughpad FZ-M1 is the only device that satisfies all the necessary conditions: It should be 7-inch in size; it should have dust- and water-resistant design to withstand use in logistics sites; and it should be Windows-based," Mr. Uchida explained. The tablet offers a mode whereby users can operate it with gloves on when they wear gloves to perform their job, comes with high-capacity batteries that last a longer time, and is equipped with a hot swapping function that makes it possible to replace the batteries without stopping or shutting down the operating system. These features met JPR's requirements. This was also the reason that JPR has decided to introduce FZ-M1.

Introduction benefits

The RFID tag data are read while RFID-tagged pallets are loaded/unloaded with a forklift. The Toughpad tablet devices have made it easier to manage individual pallets at all the depots.

On a trial basis, JPR used FZ-M1 to put into operation the Tag Reading Fork at some logistics bases. It recognized various merits of using the system through the trial, and then decided to launch the full-scale operation of it in 15 logistics bases throughout Japan. In contrast to the above-mentioned gate-type readers, which were restricted with regard to workflow and traffic lines for people and cargo, the Tag Reading Fork is not subject to any constraints. The system is designed to read pallet tag data while returned pallets are unloaded or pallets to be rented are loaded. The Tag Reading Fork enables the reading of the data of RFID tags attached to pallets, preventing excessive loads from being added to any operations.

The whole process of reading the RFID tags is as follows: When forklift operators use QR code readers to read the data of job slips, the data are transmitted to FZ-M1. When the forks of forklifts are inserted all the way into pallets, photoelectric sensors mounted between the forks turn ON. Then, the data of the pallets' RFID tags are transmitted to FZ-M1 via an antenna mounted on the forks' poles. On the device, the tag data will be analyzed to identify only the identification information of the pallets placed on the forks and the data are transmitted. This entire

process takes only 14 to 15 seconds. JPR maintains its own perspective as a company that is well versed in the actual situation at logistics sites. Based on such a unique point of view, JPR has succeeded in achieving the development of the above simplified reading process that never interrupts any operations. For an antenna that is mounted on forklifts, it is very difficult to narrow down the range of the number of tags on forklift forks that can be read via the antenna, such as ranging from 1 to 34 tags. To obtain such a narrow range, JPR set radio frequencies to be transmitted from the bottom to the front end part of forklift forks and to be spread like a fan in a vertical direction. In spite of this setting, JPR still faced a difficulty: The data of those other than target tags was also read. The company thus used an algorithm to solve this problem.

Mr. Uchida said, "We turned our attention to the movement of forklifts. After forklifts carrying pallets start to move, those other than target pallets are left behind. We thus considered that it would be possible to prevent unnecessary tag data from being read if the data of RFID-tagged pallets could be continuously read not only at the moment they are placed on the forks, but also when they are lifted and moved with forklifts." Based on this innovative idea, the Tag Reading Fork has been developed to identify only RFID-tagged pallets that are placed on the forks. After being verified by practical tests, the Tag Reading Fork was put into operation. A patent application for this system was eventually applied.

The performance of this innovative system

FZ-G1 is used to inspect the quality of RFID tags. Each RFID tag is read by sensors that are installed in the washing and cleaning line. The evaluation of whether or not radio frequencies are properly transmitted from the tags will be conducted on FZ-G1.

heavily relies on the superior stability of FZ-M1 in terms of hardware.

Mr. Sato said, "In our company, forklifts continue to be in operation for more than 10 hours during the peak period. Although the forklift operators work on a shift basis, we cannot afford to interrupt the operation of field machinery. As FZ-M1 provides 15 to 16 hours of continuous use with an optional battery and its large on-board batteries, we can use the device to operate the Tag Reading Fork without interrupting any operations in the field." Through its effort to manage individual rental pallets with the system, JPR is aiming to maximize the operation efficiency of rental pallets and offer service programs that are best suited and fine-tuned to meet the needs of customers.

JPR also uses FZ-G1 to inspect the quality of RFID tags, which are the key to the success of such services based on the RFID technology. The company has developed and put into operation a new system capable of determining if RFID tags are valid or not.

"This system enables us to detect and eliminate defective RFID tags and prevent multiple RFID tags from being attached to the same pallet. This system, serving as an information management system in our company, can be used as a reliable product that continues to deliver high-quality performance in customers' logistics bases, too," said Mr. Sato, who fully appreciates the advantages of using FZ-G1.

Future outlook of using Toughpad

JPR makes efforts to provide higher-quality rental pallets with RFID tags and logistics solutions to customers. By doing this, the company will contribute to the development of the Internet of Things in the field of logistics.

Going forward, JPR plans to incorporate an optional QR code reader into FZ-M1 to reduce the amount of equipment that needs to be mounted on forklifts. With regard to software, the company is striving to shorten the time required to read tag data with the Tag Reading Fork and to seek a new way to utilize the obtained data. This is intended to elaborately apply FZ-M1 to field operations such as temporary storage, in which the length of time that forklifts are in operation is shorter. Through such efforts, JPR is aiming to finely coordinate the operations in its depots. Leveraging its expertise on pallet data management, the company will work to achieve the goal of developing and providing logistics solutions for customers in the foreseeable future.

Mr. Sato spoke of the future vision of JPR concerning the Tag Reading Fork as follows: "The Tag Reading Fork is available for various applications. For example, the system can be linked directly with the customers' equipment as well as systems managing individual products which our company is developing. As the trend of the management of individual products is accelerated, we also expect the Tag Reading Fork to help the development of the Internet of Things in the field of logistics."

Product: Toughpad FZ-M1,Toughpad FZ-G1
Purpose: Tablet device to operate and control a "Tag Reading Fork" system

Benefit 1

Devices that can be added as an option to forklifts that are currently in use.
No need to remodel existing depot buildings in order to introduce the devices.

Benefit 2

Capable of ensuring that the data of RFID tags placed on forklift forks are read.

Benefit 3

Available for various applications. For example, the devices can be used to carry out visual control of the current conditions and traceability of each pallet, or can be designed to interoperate with a wide variety of systems.

* Information in the article is current as of the date the interview was conducted (September 2017).

For inquiries, please contact:

TOUGHBOOK