Life Jacket Rental Management Solution Using RFID Tags

RFID tags incorporating very small IC chips are being introduced in a range of settings both inside and outside of Japan, such as for SCM (Supply Chain Management) or stock control and inventory management. NEC Hong Kong is one of NEC's overseas local subsidiaries that has actively been developing RFID-based solutions from a very early stage, including an RFID based, library book borrowing management system.

This article introduces a life jacket rental management solution using RFID tags in the UHF band, which NEC Hong Kong delivered to the client in the fall of 2005.

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System Outline

NEC Hong Kong supplied a life jacket rental management solution using UHF-band RFID tags to one of the water sports centers* in Hong Kong Island in the fall of 2005.

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*Accommodation/training facilities equipped with the facilities for learning the skills in windsurfing, kayaking, etc.

After receipt of the order for this system in the spring of 2005, NEC Hong Kong developed the application and performed total SI by using a UHF band featuring a long readout distance for the RFID tag read/write devices.

With this system, RFID tags are attached to the life jackets at the water sport center's facilities where users will check out for kayaking, windsurfing, etc. The RFID read/write devices installed in the facility reads out the RFID tags to achieve automatic readout and monitoring the status of the lending
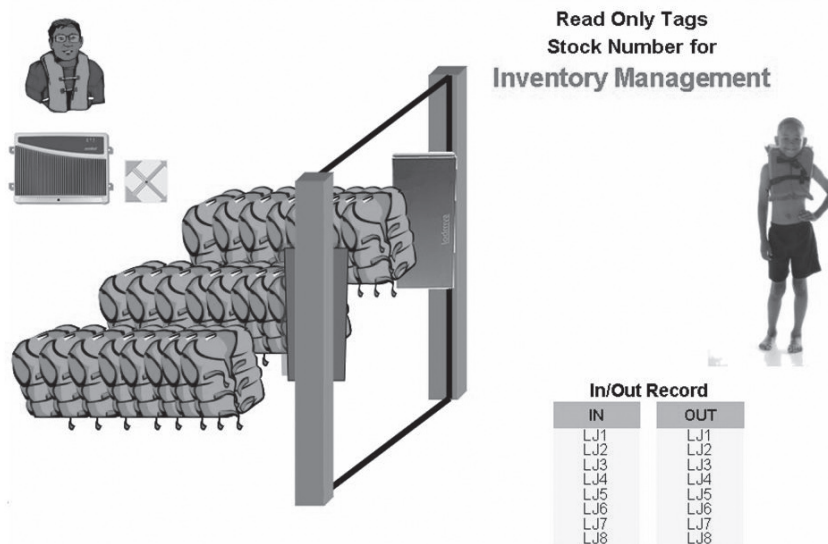

Fig.   System image.

and returning of life jackets, or even during the facility's maintenance period.

Technical Issues

With this system, the RFID tags on the life jackets are read automatically by the read/write devices installed around the jacket storage shelves. The resulting system derives from solving the following major technical problems;

1) The installation and setup of the antennae for the accurate readout of RFID tags, and;
2) The method of attaching tags to the life jackets.

Point 1) proved to be a very difficult problem to solve, mainly because the life jackets managed by the system are always wet after being used and stacked for storage. Such conditions hinder the radio waves emitted from the RFID read/write devices from reaching the RFID tags due to the wet environment.

NEC Hong Kong solved this problem in cooperation with their local agents by adopting the UHF-band RFID read/write devices being used in the cargo management systems at the Hong Kong International Airport. They tested the read/write device installation locations, antenna angles and radio wave output patterns for reading the RFID tags on the life jackets. As a result of various tests, NEC Hong Kong succeeded in improving the readout rate by installing four antennae effectively arranged around the life jacket shelves.

For issue 2) concerning the tag attachment positions, this also involved a similar problem to 1) because the radio waves were not able to reach the target effectively and the tags also tend to become damaged if the tags are wet. After trial and error measures, including the fabrication of several prototypes and repeated readout testing in the field, NEC Hong Kong eventually created the optimum, sure tag attachment method. This consisted of a pocket made of a special water resistance material being attached to each jacket with an RFID tag placed in the pocket.

The Effects of the System Introduction, and Future Plans

As this system automatically identifies the number of rented life jackets, it has improved the efficiency of inventory operations that have previously been done by manual counting and it is also improves the visualization the rental situation. Since the automatic stocktaking of the number of shelved life jackets also helps identify the number of the life jacket users who have returned to shore safely, the system has brought the further advantage that is able to detect the possibility of sea ac-

cidents.

At present, there are more than 40 batching facilities like the water sport center. NEC Hong Kong is planning to develop its business interests with the RFID-based management of other sports gear solutions being applied at other sports centers. It also plans to expand its solutions business by encouraging further applications of RFID systems. This policy is expected to be one of the key components in supporting the Ubiquitous society to come.

FOCUS POINT

Displays of the application developed by NEC Hong Kong. The application can display the readout situations of the RFID tags attached to the life jackets and the setup of the antennae for reading the tags. (The figure on the left shows the population matrix of the life jackets and that on the right shows the number of shelved life jackets read by the read/write devices.)

When the number equal to the total number of life jackets is read out, the system assumes that all of the users have returned to the shore safely and the lamp at the top left is switched from red to green.

During use of life jackets

After collecting all of the life jackets