

# Vending Machine Business Processes Enhanced with ICT Solutions

PERERA, Madhura\* KIMURA, Tomohiko\* YANAGAWA, Hiroyuki\*

## ABSTRACT

The diversification of vending machine functions has increased and complicated business operations. At the same time, the declining birthrate and aging population has made it harder to secure workers. Fuji Electric has thus started offering services that improve business processes of vending machine operators by building an operation support system that utilizes information and communication technology (ICT). This system consists of service applications, cloud data services, and a global communication platform. The system connects vending machines, communication devices, base stations, switching centers, cloud servers, and customer systems via communication lines.

## 1. Introduction

In Japan, the government is pushing a reform of working styles by laying down the legal systems to support various working styles in order to address the decrease in the working-age population caused by the declining birthrate and aging population, to balance work with child rearing or nursing care and to improve the problem of long working hours.

Due to expanding beverage sales channels such as supermarkets and convenience stores, vending machine operators (companies that install and operate vending machines) are facing risks with regard to business profits, such as decreased sales of beverages sold from vending machines, increased and more complicated business operations caused by the diversification of vending machine functions, difficulty of securing workers and rising labor costs. Under such circumstances, the operators are not only reinforcing the marketability of their products but also driving a reform of their profit structure such as by reducing the procurement and operation costs per vending machine.

This paper describes services that help vending machine operators to increase sales and improve profits by improving business processes of vending machines utilizing information and communications technology (ICT).

## 2. Overview of Services Using ICT Solutions

Fuji Electric has started offering services that improve business processes of vending machine operators by building a service system that utilizes ICT as shown in Table 1. Figure 1 shows a general-purpose cloud sys-

Table 1 Examples of business process improvement

Item	Improvement
Sales increase	Opportunity loss reduction
	Product marketing
Profit improvement (Business efficiency improvement)	Proper inventory
	Disposal loss reduction (expiration date management)
	Operation efficiency improvement

tem for offering services to improve business processes.

This system consists of service applications, cloud data services and a global communication platform. The service applications provide valuable information and services generated by the cloud service to stakeholders concerning the vending machine business such as beverage manufacturers, operators, owners and acquirers\*<sup>1</sup>. The cloud data services collect data from vending machines through a global communication platform and save it as big data. The global communication platform works as a communication infrastructure to connect vending machines and the cloud services.

### (1) Service applications

The service applications provide various services such as QR code\*<sup>2</sup> and other Internet payment services, a points-awarding service based on sales information, remote management service through remote monitoring and trend analysis and other information services.

### (2) Cloud data services

The cloud data services store and process data ob-

\* Food & Beverage Distribution Business Group, Fuji Electric Co., Ltd.

\*1: Acquirer is a company that acquires and manages affiliated merchants on cashless payment services.

\*2: QR code is a trademark or registered trademark of Denso Wave Incorporated.

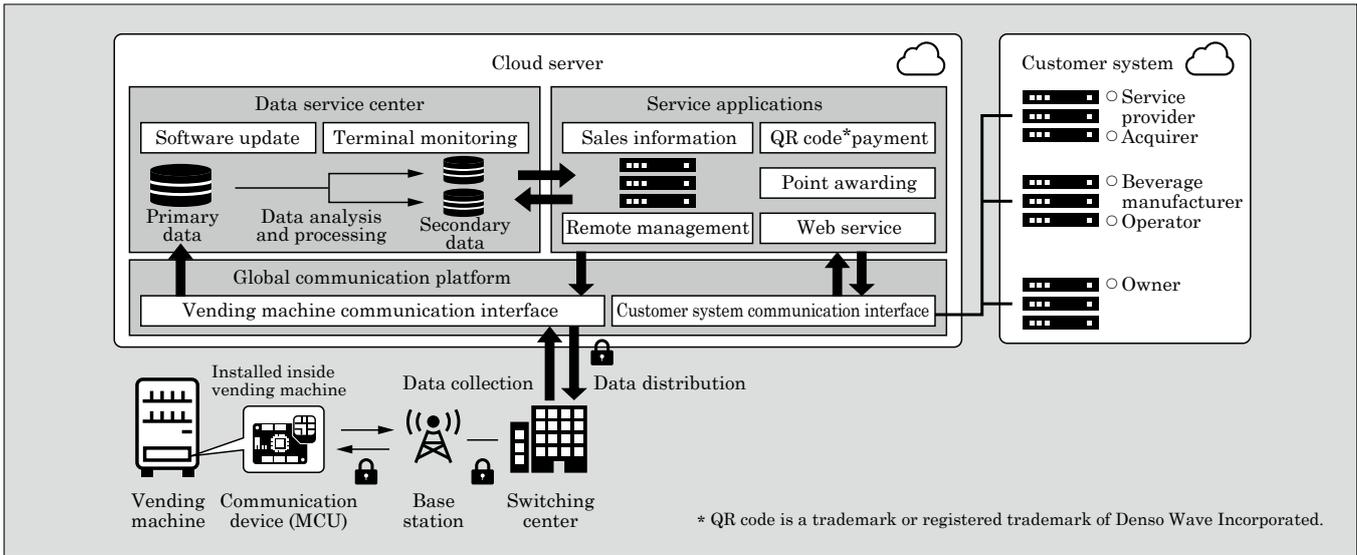


Fig.1 Service using general-purpose cloud system

tained from vending machines and provide them as valuable data through the service applications. They also offer basic remote monitoring functions such as vending machine monitoring and software updates.

(3) Global communication platform

The global communication platform is a communication infrastructure for connecting vending machines to the cloud services. It integrates vending machines with different specifications to ensure efficient communications.

This platform is also helping in the development of the specifications of the “New platform for the next-generation vending machine network” being prepared by the Japan Vending System Manufacturers Association (JVMA).

3. Features

3.1 System configuration

(1) General configuration

The services using a general-purpose cloud system are provided by a configuration in which vending machines, communication devices, base stations, switching centers, cloud servers and customer systems are connected via communication lines (see Fig. 1).

The data sent from vending machines are safely delivered from the cloud server to the customer systems via a 3 G/LTE closed network. Vending machines support three communication protocols, TCP, MQTT and HTTP, and can flexibly select them depending on the situation. For example, operators can select TCP to reduce data communication costs as much as possible, MQTT to implement real-time bi-directional communication from each system, and HTTP to send large-size data such as image data.

(2) Communication device (MCU)

A multi communication unit (MCU) is one of the important devices for setting up an ICT solution-based

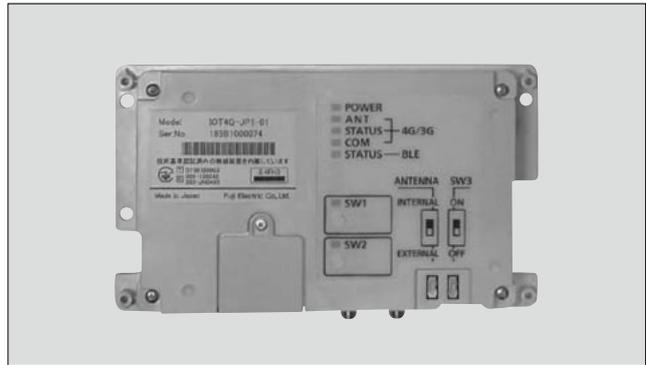


Fig.2 Multi communication unit (MCU)

service (see Fig. 2). An MCU can also be connected to existing vending machines. It has both a BLE 4.2-compliant module and a Cat-4-compliant LTE communication module to allow access to various types of network equipment. Vending machines equipped with MCUs can communicate directly with smartphones and servers.

Operators can make their MCUs also meet various other international communication standards by just inserting a 3 G/LTE module supporting those standards into the motherboard.

(3) Cloud server

The use of cloud services reduces introduction costs and achieved flexible scalability compared with conventional on-premises\*3 server building. This allows operators to perform the Proof of Concept (PoC) of their business models at low cost.

Operators can also use Platform as a Service (PaaS) offered by cloud providers to shorten the cloud

\*3: On-premises is a style of service where servers, software and other information systems are installed, introduced and operated within the facility managed by a user (usually a company).

server building period and save on running costs.

As Fig. 1 shows, data sent from a vending machine is loaded into the cloud after undergoing protocol conversion by the gateway. The loaded data are analyzed and stored in the database. The stored data are sent to users on request as necessary.

### 3.2 Service applications

The following are application examples for improving sales and profits:

#### (1) QR code payment

Cashless payment is expanding in and outside Japan. China, in particular, shows a high ratio of cashless payment. Japanese companies have made capital investments to capture inbound tourism demand by accepting QR code payment services popular in China, such as Alipay\*<sup>4</sup> and WeChat Pay\*<sup>5</sup>. In addition, more and more Japanese major service providers engaging in electronic commerce (EC) have been entering into payment services. LINE Pay\*<sup>6</sup>, PayPay\*<sup>7</sup> and Rakuten Pay\*<sup>8</sup> use QR code as a payment method.

There are two types of QR code payment: A user scan method where the buyer (user) reads the QR code shown by the seller (store), and a store scan method where the seller reads the QR code shown by the buyer. Vending machines use the user scan method as shown in Fig. 3. The QR code payment function allows beverage manufacturers and operators to capture inbound tourism demand through vending machines, and this will lead to a sales increase (per machine).

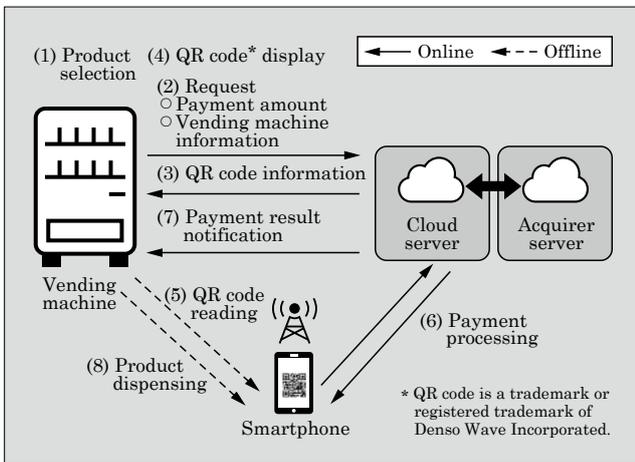


Fig.3 System configuration of QR code payment

- \*4: Alipay is a trademark or registered trademark of Alibaba Group Holding Limited.
- \*5: WeChat Pay is a trademark or registered trademark of Tencent Holdings Limited.
- \*6: LINE Pay is a trademark or registered trademark of LINE Corporation.
- \*7: PayPay is a trademark or registered trademark of Yahoo Japan Corporation.
- \*8: Rakuten Pay is a trademark or registered trademark of Rakuten, Inc.

Vending machines with a QR code payment function will have a better chance of being installed in locations with better conditions than conventional machines do. Consequently, they also contribute to the proliferation of payment infrastructure provided by the service providers.

#### (2) Point awarding

The aim of the points-awarding service is to encourage purchases and lock-in users, thereby increase sales made through vending machines (per machine). Buyers earn some points when they purchase a product. When the earned points reach a specific amount, the buyer can obtain a benefit such as exchanging the points for a product or receiving a beverage free of charge.

Fuji Electric has built a points-awarding system in cooperation with beverage manufacturers (see Fig. 4). The system uses Bluetooth\*<sup>9</sup> to send payment information from a vending machine to the smartphone of a buyer. The point server awards points to the buyer on the basis of that information.

#### (3) Remote management

The operations, including enormous number of items to be operated or set, can be broadly divided into the following categories:

- (a) Installation and removal
- (b) Payment
- (c) Product replenishment
- (d) Product changeover
- (e) Troubleshooting

For the operations that do not require on-site work, Fuji Electric built a remote management system (see Fig. 5). For the operations that require on-site work such as product replenishment, we developed a function that remotely monitors the conditions of the vending machine and its sales to achieve “one-trip operation,” that is, operators can complete the site visit just once.

At present, operators can remotely manage services such as sales data collection, setting value distri-

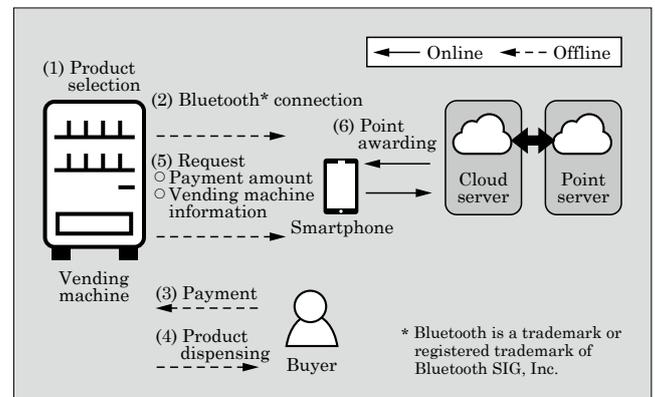


Fig.4 System configuration of points-awarding service

- \*9: Bluetooth is a trademark or registered trademark of Bluetooth SIG, Inc.

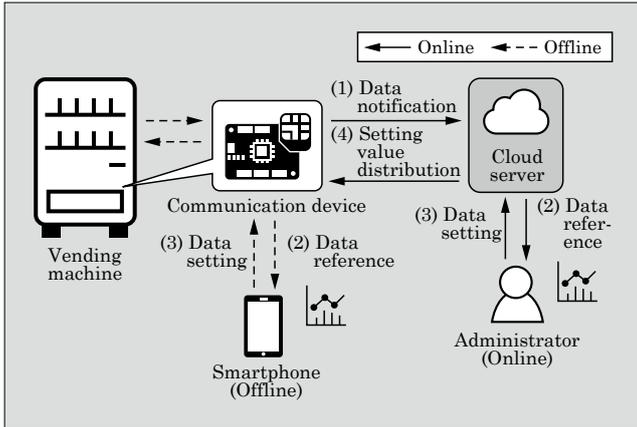


Fig.5 System configuration of remote management

bution, content distribution, logging and firmware distribution. We will work with prediction engines in the cloud to further improve the operations.

#### 4. Business Models

- (1) Retention and expansion of vending machine market (present)

By utilizing the ICT solutions and establishing an open structure for vending machines as described above, Fuji Electric is lowering the hurdles to entering the vending machine market and energizing the market both in and outside Japan. We think that this will

allow operators that could not enter the vending machine market before to build a system for designing unprecedented business models and creating new added value for vending machines.

- (2) Business model innovation (future)

In the future, Fuji Electric will provide a one-stop service that combines multiple products and solutions by connecting various commercial items to a network. By building our own cloud services, Fuji Electric will constantly offer customers the latest functions, such as that for subscription service replacing product selling. We will continue providing new services to bring about business innovation and offer platforms that allow our business partners to build business models leading to an increase in their profits.

#### 5. Postscript

This paper described the improvement of vending machine business processes through the use of ICT solutions. The product value improvement achieved through the use of ICT solutions is only a sustaining innovation at the present moment. Fuji Electric is determined to continuously improve its support for the Internet of Things (IoT) and the open structure of our products to encourage the entry of new business partners and actively try destructive innovation so as to change business.





\* All brand names and product names in this journal might be trademarks or registered trademarks of their respective companies.