A Study on Environmental Monitoring using Sensors for Cold Chain System

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Abstract. In recent, as we have seen food many poisoning accidents, food delivery in optimal condition is regraded as an important issue because it is directly linked to the health of the consumers. In order to deal with this food delivery issues, many delivery companies have been conducting a pilot project for building the cold chain system. Cold chain is an integrated system in which agricultural products, meat, fruit and vegetables, beverages and other grocery are kept optimal conditions during the transport and storage, starting at main producing areas and ending with the customer. Foods exposed to temperatures above the recommended temperature range experience some loss of foods quality. Therefore, we need a monitoring and control system to periodically check the status of environment using environmental sensors(e.g.,temperature and humidity). In this paper, we propose a method for monitoring the environmental status of delivery vehicles from remote area. We use temperature and humidity sensors for environmental monitoring and ZigBee and set-top box equipped with mobile communication module such that it is possible to monitor the status in a real time from remote areas. Under the proposed system, if temperature or humidity above the appropriate level, we pass a warning signal to the driver and the remote area so that the quality of foods are kept in optimal conditions.

Keywords: Sensors, USN, RFID, ZigBee, Cold Chain, Environmental Monitoring.

1 Introduction

In recent, as the quality of requirements for consumer increases due to the well-being culture, the demand for safety in cold chain system has been increased. In the

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case of foods, how to deliver from the producer to the consumer's home influences the price of the products. Due to the fact that foods are directly related to the health of consumers, keeping the products (foods) and managing them in the appropriate environmental conditions are very important in logistics system[1-7].

In this paper, we propose the method which is efficiently applied to cold chain system by using the technologies of Sensors, Zigbee, mobile communications. In chapter 2, we introduce our proposed system. Performance evaluation is followed in Chapter 3. Finally, we conclude this paper in Chapter 4.

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2 Real-time Localization and Environmental Monitoring

Our proposed system is composed of two parts: i) environmental monitoring, and ii) real-time communication for transferring sensing data and localization information to remote area. In order to monitor the environments, we use temperature and humidity sensors for environmental monitoring and ZigBee and set-top box equipped with mobile communication module such that it is possible to monitor the status in a real time from remote areas. ZigBee based set-top box mainly performs gathering temperature, humidity, and the other sensing information of the delivery vehicles. In general, both ZigBee in the set-top box and RF communication by using the sensor module are used for gathering the information. Sensor modules are distributed inside and outside of product box according to the environment of the vehicles or the characteristics of the products such that all sensing data gathered are transferred to the set-top box through RF communication in ZigBee.

3 Performance Evaluation

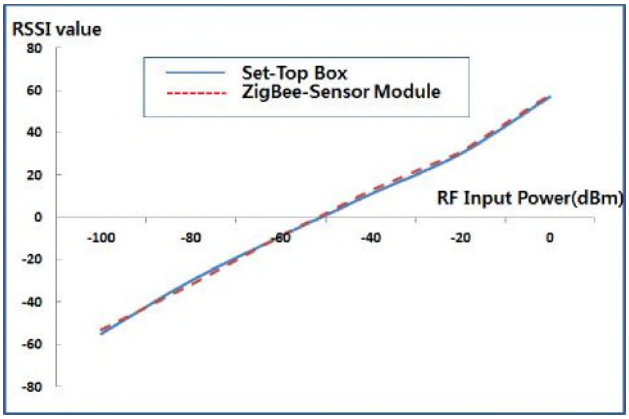

Figure 1. RSSI value w.r.t., RF input power devices.

In order to verify the performance of the proposed system, we first measure the communication sensitivity of temperature and humidity from ZigBee based sensor modules and set-top box. We also check the RF communication sensitivity between the set-top box and sensor modules. Figure 1 shows the RSSI value when the RF coaxial cable of signal generator is directly connected while the sensor module and the antenna of the set-top box are removed. In the measurement of RSSI value, as the signal power of RF input power increases, the corresponding RSSI values relatively increase, we can increase the communication range for the high RF output power. Consequently, we can cover all the area of the vehicle.

4 Conclusion

In this paper, we proposed the method for gathering environmental information such as temperature and humidity by using the sensors and transferring the data to the administrative server in the remote area. We believe that the proposed method can improve the utilization of the cold chain system and its applications. For the measurements of environmental data, we use commercial temperature and humidity sensors and ZigBee technology.

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