The Design of Laundry System for Low Power and Smart Management

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ABSTRACT

In this paper, we proposes the design of laundry system for low power and smart management. The low power system configures the network with the RF communication module that turn on/off periodically, power consumption less than operating the module all the time without it toggles. The smart management is RFID Laundry Management System (LMS), in order to provide high services, low operation costs and better monitoring. The proposed system consists of RFID tag, wireless RFID hanger and MFC software. To compare with other existing RFID system, our system was developed as a web application. Therefore, customer can check their cloth status through web page or smart - phone devices. RFID reader was designed on hanger to make our system enables reliable running effectively. Some results on the performance of an implementation are presented.

Keywords

RFID Laundry Management System, Low Power, Wireless RFID Hanger, MFC Software.

Ⅰ. Introduction

Radio Frequency Identification (RFID) is the next generation wireless communication technology applicable to various areas such as distribution, circulation, transportation, etc. RFID is a non-contact technology that identifies objects attached with tags [1][3].

An intelligent laundry store can manage customer data, can give customers know where their clothes locate, which processes are done, and what time is appropriate to go to shop to take their washed clothes back[4-5].

We proposes the design of laundry system for low power consumption and smart management. Propose the low power system configures the Network with the RF communication module that turn on/off periodically, power consumption less than operating the module all the time without it toggles. The smart management is RFID Laundry Management System, in order to provide high services, low operation costs and better monitoring. At this system, to set an ID on each clothes, a shop assistant attach a washable RFID tag on every clothes at the beginning when he received the clothes from customs, and he will take off those tags from clothes when these clothes is returned to customs. Therefore, an operator can monitor all washing processes and transportation route of the tagged clothes by monitoring the positions and the logged time of the attached tags.

The paper is organized as follows. Section II provides an overview of research related to applications with RFID and low power system. In Section III Design and Implementation is discussed. The results of the system are experimented in Section IV. Finally, in Section V we conclude the paper.

Ⅱ. Related Work

RFID is a means of storing and retrieving data through electromagnetic transmission using a radio frequency (RF)-compatible integrated circuit. Today, RFID is applied widely in supply-chain tracking, retail stock management, parking access control, library book tracking, marathon races, airline luggage tracking, electronic security keys, toll collection, theft prevention, and healthcare. A number of different approaches have been proposed for the RFID applications. An RFID system usually consists of three main components: tags, readers and the supporting software. A tag has a unique identification number (ID) and memory that stores additional data such as manufacturer name, product type, and environmental factors including temperature, humidity, and so on. The reader can read and/or write data to tags through wireless transmissions. The supporting software can map the virtual IDs (the ID of RIFD tags) to the real world objects. In a typical RFID application, tags are attached or embedded in objects that must be identified or tracked. By reading nearby tag IDs and then consulting a background database that provides mapping between IDs and objects, the reader can monitor the existence of the corresponding objects.

The current technology of low power system in wireless sensor network has developed various algorithms such as clustering network, election of cluster head, selection of optimum route in multi hop sensor network, and so on. These algorithms optimize used each application system and are saved power consumption. For example Fig. 1 shows clustering network. Each tag node Cluster Head (CH) transmits the data to base station. And in this system, each tag node CH is the same like the base station those receive data from around tag node Cluster Node (CN)[5-6].

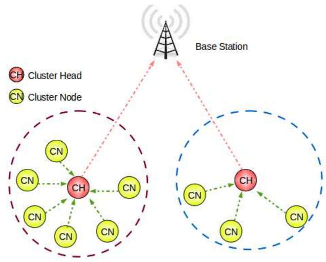

Fig. 1 Clustering network

Ⅲ. Proposed Laundry System

Customer visits laundry store in order to clean their clothes, operator attaches RFID tag on the cloth, and then using the interface management program based on PC (MFC) to read and registers customer's information, all the information will be saved on database MS Access . Users can monitor the clothes status by tracing the id of the attached tags. After laundry is washed, clothes will hanged on the wireless hanger.

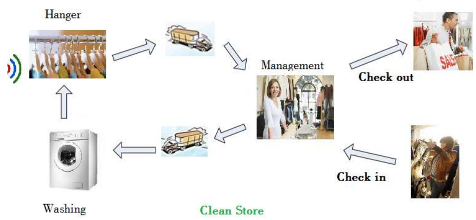

Fig. 2 Overall Laundry System

The server periodically checks for status of wireless hangers. When the customer will come to take back their clothes, operator will find clothes by searching command on PC, via wireless link. The overall laundry system is shown in Fig. 2.

3.1 Proposed RFID Hanger

The wireless hanger consists of RFID reader, wireless sensor node, and LED. In our system, we use RFID Mini Reader (FS-MR305S) from FirmSYS, because of its small size. Antenna design is a critical element of the system. To maintain accuracy, the antenna should be in close proximity to the RFID reader so that our result is correct. The reader, it is also can connect with external antenna to extend read range up to 90mm, it is reasonable to read the tag on cloth from hanger. The wireless RFID hanger was designed like Fig. 3.

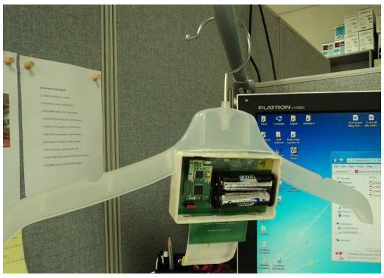

Fig. 6 Wireless RFID hanger design

Other critical element of the system is communication between PC and RFID reader. In our system, we use Kmote−B Fig. 4, it is integrated onboard antenna with 50m range in doors and 125m range outdoors, because it is suitable with laundry store scale.

Fig. 7 Kmote−B

3.2 Software of Laundry System

In terms of software, we used MFC and Microsoft access as our real−time database to save customer's information and tags data. MFC supported to connect with MS Access database through Open Database Connectivity (ODBC) [2]. Packet structure is shown in Table 1.

Table 1. Packet structure

Field		Size byte
PAYLOAD	Source ID	2
	Destination ID	2
	Command	2
	Data	12
	Sequence	2
	RSSI	2
	LQI	2
	Battery	2

3.3 Proposed Low Power consumption

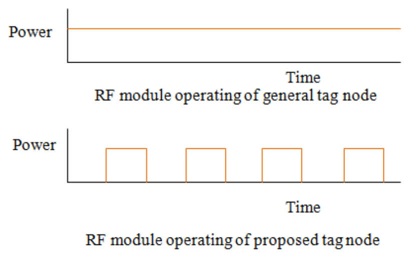

Fig. 5 Comparison of general and proposed tag node

Generally RF module is always turned on. But proposed system is toggled states on/off. The RF module of the tag node operate at 0.3 second cycle, the comparison is shown in Fig. 5. The tag node can not catch the data in RF module off cycle, in order to avoid data loss and saving power, the base station algorithm of transmission and reception was used. The tag node cannot catch the data in RF module off cycle. So we have to handle for saving data. In order to prevent losing data, counter synchronization was used, it reduces losing data between tag node and base station. The tag node has 16 bits as counter bit and these bits are used to operate the system. This counter bit controls the cycle of RF module on/off. On the basis of the counter bit of the base station, the counter bit of the tag node updates. The tag node counter bit update in initial operation like Fig. 6.

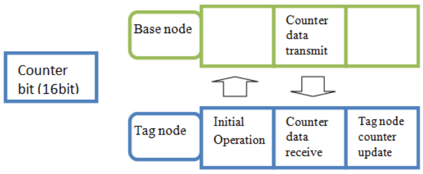

Fig. 9 Tag note counter update in initial operation

Ⅳ. Experiment and Discussion

Our system was set−up like Fig. 7, the tag was attached on cloth, and then was holding on hanger with RFID reader. Another RFID reader (read input tags) and Kmote−B was connected with PC. After that we did some experiments with the system

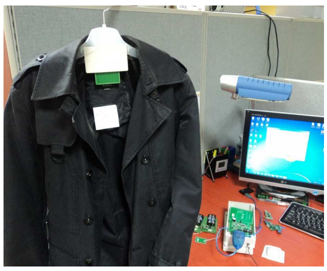

Fig. 7 System for implementation

4.1 Experimental result of RFID Reader

The recognition rate of attached tag on clothe from RFID reader are very important that decide correction of system. The experiment was conducted between distance and recognition of

RFID reader, in order to place tags on clothes suitably. As shown in Fig. 8, with distance between RFID reader and tag from 0 to 8 cm, reader can read tag well.

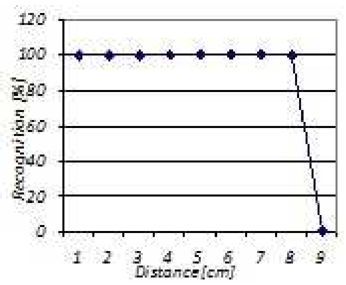

Fig. 8 Distance and recognition of RFID reader

4.2 Packet reception rate according to distance

The data is sent and received through Radio Module Kmote-B to the wireless RFID reader. The send and receive packet rate was calculated as Table 2.

Table 2. Packet Reception Rate (PRR) according to distance

Distance (m)	PRR (%)
10	100
20	100
30	100
40	99

According to experiment, the accuracy average at 40m distance is 99.75%. In case of the scale of laundry store, it is reasonable to apply.

4.2 Power Consumption Measurement

We connected a resistance 100Ω to input power of the tag node, and then measuring the output voltage through resistor. The result is shown in Fig.. 9, the battery life about two times longer than old system.

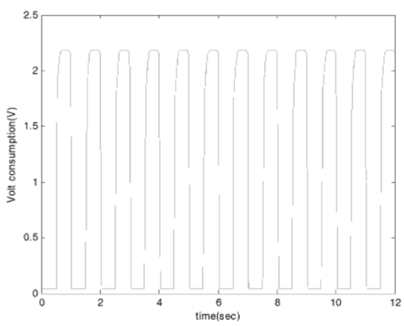

Fig.9 Volt consumption of the system

V. Conclusion

In this paper, we proposed the design of laundry system for low power and smart management. The proposed system consists of RFID tag, wireless RFID hanger and MFC software. Wireless RFID hanger for laundry management system in order to satisfy customer's demand. The proposed software was design for good performance and operation. In addition, the low power consumption algorithm was implemented, the battery life in our system is about two times longer than old system's.

Acknowledgement

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