International Journal of Scientific Research in Computer Science, Engineering and Information Technology
© 2017 IJSRCSEIT | Volume 2 | Issue 2 | ISSN : 2456-3307

RFID-Based Laundry Management System

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ABSTRACT

In this paper, we propose a RFID-based Laundry Management System (LMS), in order to provide low power consumption, low operation, high services costs and better monitoring. The proposed system consists of a 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 able to be reliable and running effectively.

Keywords : IoT, RFID, MFC, LMS

I. INTRODUCTION

Up to now, most of the laundry stores/shops use barcode label to identify cloth/garments, therefore, they have to be read closely, and only one code could be read in the process. These weak points can decrease productivity and increase rate of defectiveness. In order to resolve the problems mentioned above, we apply RFID for laundry management system, and it makes it possible for one reader to simultaneously read many tags, very quickly. This is one of major advantages compared to barcode solution. RFID reader is also possible to read these tags about 2meter distance away from antenna of the reader. This feature can help laundry management system to locate identified cloth/garments by RFID reader efficiently and rapidly. RFID is a technology used for object identification, which finds various applications in retail, transportation, manufacturing and supply chains [2].

II. METHODS AND MATERIAL

RFID LAUNDRY INVENTORY SYSTEM

This paper describes a case study of how RFID technology can be used to simplify the operations and improve the effectiveness and efficiency of laundry management. This use-case gives a better understanding of the main advantages of the proposed platform and shows the benefits of its implementation to a real application environment. Since the laundry RFID tags can be attached to cloth or linen, the possibility of reading laundry information has raised opportunities for automatic identification. The IoT technology is opening new frontiers for modifying, improving processes and consumer interactions and even the entire business models can be fine-tuned to take advantage of accessible data. It will have implications for organizational-structures, as well as for the way of how decisions are made, operations are managed, and also for optimization of processes in which traditional approaches have not brought satisfactory results. Changes in information patterns have created a market for entirely new solutions and more innovative ways to enable new services, smarter decisions and business models, and reduce costs. [3]

There are use-cases related to the requirements of a laundry management system and managerial implication. For example, a manual laundry tracking process is a very labour intensive, because obtaining detailed records requires it to count, separate, record (may be by handwriting notes) and insert into a computer for each different types of laundry items. Cost effective and efficient laundry management demands sophisticated laundry management software and tagging systems. An advanced automatic identification technology based on the RFID technology would have significant added value for the inventory systems (i.e. computer data can show in real-

time if the inventory stored in the stock is correct and has adequate quantity).This solution with many managerial implications can reduce the time and effort necessary for processing, shipping and receiving the laundry and provide ultimate control and accountability in the process of laundry circulation - (e.g. status, current location, last recorded time, number of left washing cycles, information about used material, washing conditions, and so on.).[3] The basic infrastructure necessary for this type of practical application includes readers and tags, as well as RFID management software, all designed to work together seamlessly. It was necessary to map the processes to refine the system requirements. The requirements for locating RFID readers for comprehensive coverage were identified by mapping the movement of monitored laundry items. Based on the results of mapping a process, the possible readers' location and requirements for the RFID readers, and modes of operation has to be determined. The system allows four basic modes, namely:

- ✓ Simple reporting, single report mode – in this mode, the first occurrence of the monitored items is reported. As long as the item leaves the signal range of the antenna for a specified period of time, there will be no further reporting.
- ✓ Simple reporting by each antenna– this mode is similar to simple reporting, but associated with a single antenna. If the laundry is moved within the second antenna signal range, it is reported by the other antenna.
- ✓ Periodic reporting – in this mode, if the laundry is within range of the antenna, there will be a periodic report from the antennas with the strongest signal.
- ✓ Detection of passage direction – in the case of two, or a multi – port reader, passage direction is determined on the basis of signals from the antennas. For example, if the first antenna is considered external antenna and a second antenna for the internal antenna, the passage between 1 and 2 is reported as the direction of "IN" and the passage between 1 and 2 is reported as "OUT".

III. RESULTS AND DISCUSSION

All of these modes can be used on any connected reader. Algorithms for evaluating signals from readers are implemented at the middleware level. The modularity of the solution then lies in the possibility of adding another RFID reader. This reader can be operated in any of the four modes described above [1]. The information gained from the report of the readers and antennas can thus be used for specific use applications.

A general schematic of laundry circulation is in Figure 1.

Figure 1 : Laundry System Example

All operations and steps which follow the movement of linen from the wash machines to user and back are illustrated. Linen/Items can be monitored during or after all these steps. The system operator has real-time information about the actual position of single linen item, but also about its general condition (e.g. number of completed washing cycles and its condition), total amounts, losses and damages, and can immediately react to new linen requests. The RFID IoT system can be very helpful in processes where the operator needs to be informed about the an incorrect washing program or maximum temperature of ironing of the processed linen, because all this information is managed, stored and can be provided by the RFID IoT system for laundry management [1].

Based on a detailed analysis of all operations during the laundry circulation process, we identified the best points for placement of the RFID readers and their antennas which would ideally cover the complete process of laundry circulation. There are two modes of monitoring movement of laundry items. Firstly, passage detection mode which requires only one antenna. Secondly, there is possibility of monitoring movement of items using multi - antenna readers [3].

One of the main goals of our development work was to realize a complex software module for obtaining data from readers, filtering, unifying and providing these data for following evaluation or storing into a database system in an external database server. For filtering and unifying purposes, the IoT middleware needs to control the reading processes of all connected readers and process the raw data from the antennas which contains information only about tags in the communication range of an antenna and some of the readers include the RSSI information. Collected data are analysed, filtered and processed by the algorithm for determining the direction of passage. This information is then transferred to a superior system in the form of a single iteration report.

A developer or system administrator can have access to real-time system data with processed information about the iterations of tags within detection range of readers' antennas. This makes the necessary development feedback about internal processes and general functionality of the system be readily available to the system administration.

IV.CONCLUSION

This paper presents an approach of how RFID technology can be used to simplify the processes and improve the effectiveness and efficiency of the inventory management. We have found that by using one four-port RFID reader, we can monitor four laundry operations, thereby reducing installation costs.
Also, part of our research was focused on an evaluation of reliable and fast algorithms for determining the direction of passage of the identification tag by the field of connected antennas from data from all types of RFID readers. This function which gives the information if laundry is going in or out is unique. The IoT middleware compiles the data from all the connected RFID readers, filters them and according to the selected reading mode of every single RFID reader, it applies an algorithm for further iteration evaluation. The resulting iteration reports contain all important parameters such as time, place, average signal strength, duration and direction of passage of a tag, and information about the identification tag itself which is initiator of this transaction. Collected iterations by the IoT middleware are then reported to the upper system layer for post–processing operations and storage in a database system [3].

Our future work will be focused on the realization of a web server application which will provide a Web-based Graphical User Interface for user-friendly control and management of a whole realized IoT system via the Internet, not only for classical PCs or laptop but also for smart phones and tablets.

V. REFERENCES

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