USING RFID SYSTEM BASED ON LABVIEW FOR REAL-TIME PATIENT MANAGEMENT

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ABSTRACT

We describe a radio-frequency identification tag test and measurement system for patient management based on National Instruments LabVIEW software. The system operates in 2.45GHz frequency band with a variable output power and is capable of testing 100 tags/sec. This paper describes the proof of concept of real time traceability using RFID technology and powerful LabVIEW system with high-speed signal acquisition capability. This mechanism of patient management can improve the working efficiency in current healthcare organizations while also helping to drive down costs.

Index Terms— RFID, tags, LabVIEW.

INTRODUCTION

Radio-Frequency identification (RFID) is an automatic wireless data-collection technology with a long history that can be traced back to the late 1940s [1]. Since then, RFID has significantly advanced and experienced a tremendous growth due to developments in integrated circuits and radios [2]. RFID is a killer technology that elegantly provides a solution to wide range of business needs including healthcare sector [3]. It is also observed that a medical application such as RFID-based real-time hospital patient management system offers the tremendous benefits of healthcare management systems.

In healthcare, RFID tags may be applied to people—patients and staff—and to objects, allowing readers on door frames, wards and treatment areas to detect and record interactions. There are several advantages for hospitals and health-care organizations using RFID system [4]:

Improve patient monitoring and safety;

Increase asset utilization and reduce capital costs with real-time tracking;

Dramatically decrease equipment rental costs;

Reduce medical errors by tracking medical devices.

This study intends to integrate the RFID technology to gain efficiency improvement with the help of LabVIEW.

RFID SYSTEM FOR HEALTHCARE

RFID technology provides a method to transmit and receive data from a patient to health service medical professionals without human intervention. It is an automated data capture technology that can be used to identify, track and store patient information contained on RFID tag. Although, medical professionals can access and update patient's record remotely via WiFi connection using laptops and other mobile devices [5].

RFID technology mainly consists of a smart tag, a reader and healthcare provider IT systems as shown in Figure 1. Each tag attached to the patient wristband contains an antenna and a tiny microchip smaller than a grain of sand. The antenna picks up radio-waves or electromagnetic energy beamed at it from a reader device and enables the chip to transmit patients unique ID to the reader
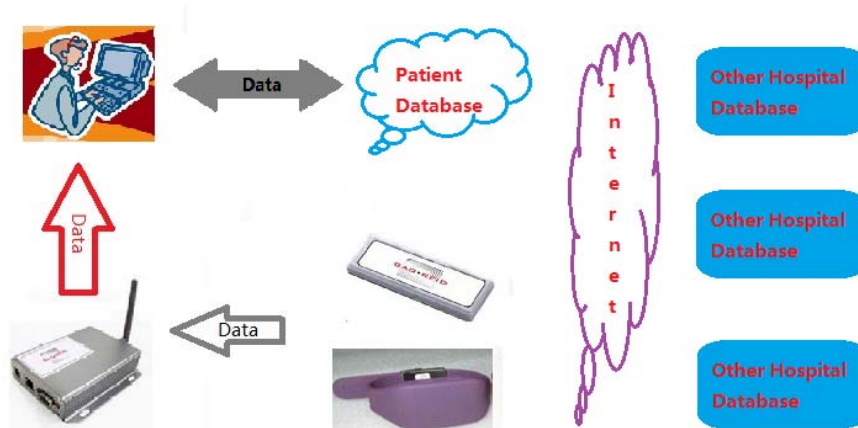
Figure 1: Main components of RFID-based patient management system

device, allowing the patient to be remotely identified. The reader converts the radio waves reflected back from the patient wristband intodigital information that can then be passed into LabVIEW program for processing. Patient's basic important data (e.g., patient ID, name, age, location, drug allergies, blood group, drugs that the patient is on today) can be stored in the Patient's back-end databases for processing. Patient databases can also be linked through Internet into other hospitals databases [6].

LABVIEW

Laboratory Virtual Instrumentation Engineering Workbench (LabVIEW) is a high-level programming language with Graphical Language developed by National Instruments. It can support interfaces such as GPIB, USB IEEE1394, MODBUS, SERIAL, PARALLEL, IRDA, TCP, UDP, Bluetooth, NET ActiveX, SMTP, etc. There are several layers to construct a RFID system, such as physical layer, middleware, data process layer and user interface layer. In our RFID system, we intend to gain efficiency improvement with the help of LabVIEW.

In contrast to conventional programming languages, LabVIEW is programmed on the basis of block diagrams and front panel elements. These elements are connected by means of a wiring tool. The main application areas are data acquisition, system management and the simulation of a digital signal processing system. The LabVIEW provides an easy-to-use graphical environment that permits the system operators to process easily the collected data, using complex data-processing algorithms, without detailed knowledge of the data-acquisition system design [7].

In our project, The TCP protocol in LabVIEW was directly utilized to get RFID code from RFID reader, and then the tags' identification number were picked up by many times of data transform. The software of RFID system that consists of executable code controlled via a graphical front panel on the screen similar to a real instrument. All tags information displayed on software interface will be saved in database through the VI of "labsql", and the information will be saved in Access of Microsoft Office.

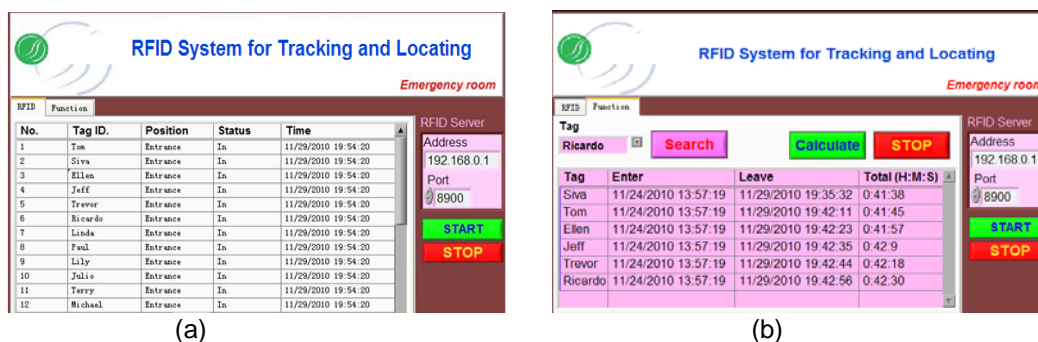(a)   (b)

Figure 2: LabVIEW interface of RFID-based patient management system

LabVIEW interface of RFID-based patient management system is shown in Figure 2. It's very easy for everyone to use the LabVIEW program. The first step is to click the "START" button and then the tags information will be shown in the LabVIEW interface, Figure 2(a). It includes the information of tag ID., position, status and the time of data acquisition. Figure 2(b) is the interface for RFID data analysis. You can search the position of any patient and calculate the time from entering to leaving the emergency room. All data are stored in Microsoft Access program for analyzing in future.

The biggest advantage to use this system is the mistakes can be detected right away. An RFID reader can read many tags concurrently and the information about the tag is sent to the system immediately. This feature can help us to find out whether the patient is at the right place or not. If the patient enters into a wrong room, the system can make alarm and show where the patient is at that moment, and the operator can deal with the problem immediately.

CONCLUSIONS

The application of RFID for the patient management in hospital is very important. It is valuable for hospital to improve their working efficiency. This work uses LabVIEW to integrate Access database and RFID technology to increase the operational efficiency, patients are identified and tracked real-time, and help patient immediately when they need. Our further work in this field is to apply the developed technique and system for large-scale application in healthcare.

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