A RFID-enabled with Data Mining Model for Exhibition Industry

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Abstract—**Taiwan has been upgraded to world-class exhibition venues. At present, the participations of the exhibition are the way to approach the scene admission tickets, or to prove that staffs wear work to enter the venue. For the case, manufacturers and exhibitors is difficult to collect information to find the potential customers. How fast and accurate to collect the information on all personnel at the exhibition is a major issue. RFID is a new technology for data collection. The benefits of RFID include: (1) Identification, without directly touching or reading machine targeting items ;(2) To identify the label other than the use of information technology most of ADC information stored in more;(3) Follow history, or re-use in the identification label change read / write the data identification label.**

In this paper, we propose a RFID-enabled with Data Mining model which start with RFID technique for fast data collection, then analyze and transform the data to useful information for exhibition industry through Data Mining.

Index Terms—**Data Mining, Exhibition, RFID**

I. INTRODUCTION

In Taiwan, Exhibition, Trade Fair/Show, Exposition and Consumer Show represent four different kinds of major performance. International Congress & Convention Association (ICCA) recently publishes country and city rankings 2007, Taipei, fortieth in 2006, climbs to 18 in 2007, the number of international meetings increased from 29 to 67, rank from 9 to 6 in Asia [1]. At present, the participations of the exhibition are the way to approach the scene admission tickets, or to prove that staffs wear work to enter the venue. Too many participators may lead to the problems as follow:

1) It takes time to collect participators' data, even the business card as well
2) Slow entrance leads to time wasting

3) If someone enter with the forge ticket, it will be hard to identify and calculate the exact numbers of entrance
4) Participators have no idea about the industry, they will miss the chance to communicate with factories
5) Factories cannot gather the data from all of the participators, it will lose the opportunities for further cooperation

This study propose a RFID-enabled with Data Mining model which start with RFID technique for fast data collection, then analyze and transform the data to useful information for exhibition industry through Data Mining, see Fig. 1.

Fig. 1 RFID-enabled with data mining model

II. BACKGROUND

A. RFID

RFID (Radio Frequency Identification) technology had already begun research on the application during the World War II, the main purpose is to identify the enemy aircraft. This technology adopts a tiny microchip which is built in the RFID tag, it can record a series of information, Such as: item ID, manufacturing date and expiration date in the whole process.

RFID system, be regarded as an important technology of this century, although RFID technology has existed for a long time, but until 2004 Wal-Mart began mandatory for its top 100 suppliers, all goods must come with RFID tags. The use of RFID tags, but also stimulate other industries also began to consider the feasibility of RFID and the application [2].

Stockman had proposed to make use of radio waves that carry identification information [3]. Since the first on the RFID patents was made after, RFID related applications has continued to facilitate conduct

Since 1970s, the RFID patent was issued, RFID related applications has continued to carry out, such as: the company access control card and contactless MRT IC card in Taipei,

Taiwan. But the cost and lack of strong promotion which have limit its application only in some high add-value applications. Till then, Wal-Mart and the U.S. Department of Defense have announced that 2005 will fully introduce RFID in their supermarkets or weapons, these huge demands had boosted its applications in other fields.

There are two major organizations working to develop international standards for RFID technologies in the UHF band. These two organizations are EPCglobal and International Standards Organization (ISO). EPCglobal released its EPC class 1 G2 protocol [4] for the UHF band at the end of 2004, and the ISO released its 18000-6 type c in August of 2004. Both standards are still evolving and are not fully compatible with each other [5]. To avoid all use of radio frequencies different standards, resulting in the use of the confusion and distress, most of the international community to comply with the International Telecommunication Union (ITU) standards.

At present the bands of RFID were 135 KHz below, 13.56 MHz, 433.92MHz, 860M ~ 930MHz (that is, UHF), 2.45GHz and 5.8 GHz. The shortcomings for 135KHz band is that only short distance, about 10 centimeters allowable, and the slow communication speed. This band in the majority of countries is opened for public, and there is no licensing and regulation issue involved, therefore it is widely used in pets control, access control and anti-theft tracking [6]. The 13.56MHz band transmission distance is limited to less than 1 meter, membership cards, identification cards, plane tickets and building access control are major applications. The UHF band RFID tags can transmit up to 5 meters distance, the quality of communication is better than the other bands, the major application is adopted for supply chain management goods tracing. The most problem raised for this system is that varying frequency and regulations in different geographic regions, Application of the cross-regional will encounter serious problems [7].

A complete RFID system comprises of reader, antenna, tags. The function for each component is:
1) Read the high-frequency electromagnetic energy and query signal generated by reader which triggers the tags to reply the query, the query frequency could be up to 50 times per second. The reader can integrate with the other AP in wire or wireless form.
2) Antenna sends wireless signals (including the Synco-Clock signal, Data, Energy) to the tags, and receive wireless message from the tags located in reachable range.
3) Tags which contain microchip that embedded information.

Each Tag has an ID Code, this ID Code is unique for the whole database, and it could only be recognized the designated database or application server [8]. A RFID system architecture is shown in Fig. 2.
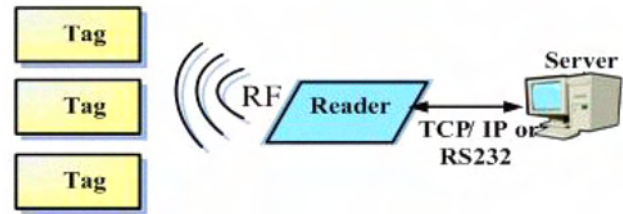

Fig. 2 RFID system architecture

The Industrial Technology Research Institute (ITRI), a group funded by the Taiwan Ministry of Economic Affairs' (MOEA) Department of Industrial Technology, has demonstrated an RFID system that allows visitors at conferences and exhibits to track their own movements, download product brochures and other information related to the booths they visited [9].

B. Knowledge discovery and data mining

Data mining can be referred as Knowledge Discovery in Database (KDD) [10]. Data mining is the process of extracting hidden patterns, special relationship and hidden benefit from data. The KDD process can be seen in Fig. 3.
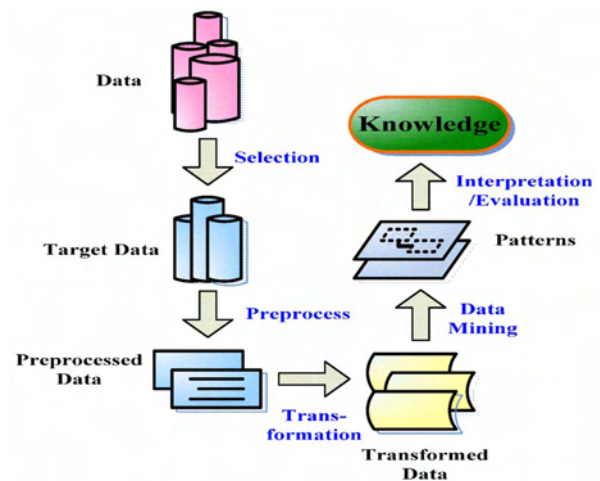

Fig. 3 Knowledge Discovery Process

The KDD process is as followed : In the beginning, select and establish target data cluster from data, and then preprocess the cluster to figure out mistakes or variance. The preprocessed data will transformed into transformed data by simplification and data switch, and Data Mining will explore the hidden patterns from the transformed data. The final step is to evaluate and interpret the patterns and turn them into knowledge. It is clear that Data Mining is one of the KDD process.

Data Mining is the process of extracting information from data, the steps are to analyze and combine data in order to provide useful information and reference materials for higher administration. Data Mining commonly involved these functions [11]:

1）Classification: Arranges the data into predefined groups.

For example level of education might attempt to classify as Doctorate (PhD), Master Degree, Bachelors Degree, High School or Junior School.

2) Estimation: Estimation is the calculated approximation of a result which is usable.

3) Prediction: Computer uses previous data to predict future results. For example, convenient store owner may predict how many products a consumer will consume by his/her historical record.

4) Affinity Grouping: Put all the same kind of objects together.

5) Clustering: Is like classification but the groups are not predefined, so the algorithm will try to group similar items together.

C. Exhibition industry

Under the trend of internationalization of each major cities in the world, MICE (Meetings, Incentives, Conventions & Exhibitions) has brought huge amount of economic profits to local. According to Ministry of Economic Affairs, each international expos brings 5 billion NT dollars and creates 13000 job opportunities, also it will attract over 5 million people to join the expos. Furthermore, it stimulates industries such as consultants, hotels, aviation, food and beverage industry, printing, and travel [12] [13].

The exhibition can be divided into four kinds of patterns [14]:

Exhibition: The purpose of an exhibition is to promote new products and provide service, and to exchange information with people in the same industry.

Trade Fair / Show: Trade shows are classified as "Professional" or "Mixed." Professional trade show demonstrates all kinds of product within the same industry while mixed come from different industries.

Exposition: An exposition is usually held for educational purpose instead of commercial.

Consumer Show: A consumer show is designed for specific products, for instance furniture, computer or video games.

III. RFID-ENABLED WITH DATA MINING MODEL

A. Construction process

First, we will install RFID-enabled with Data Mining equipment in the entrance and each booth with a RFID Reader for Tag information collect. Then we gather all participators data to establish entrance access, and calculating the attendance number for on-site security. This study assumes RFID can read 100% of all the Tags, after RFID system testing, factories may enter the venue for preparation, at the same time we will distribute RFID cards to factory representatives.

With the show opened, each visitor will receive a RFID card as administration. RFID system can collect all personnel data, and then precede analysis and Data Mining. Finally, the information may provide the factories for exchange, policy making reference, costumer tracking or sales prediction. The construction process can be seen in Fig. 4.
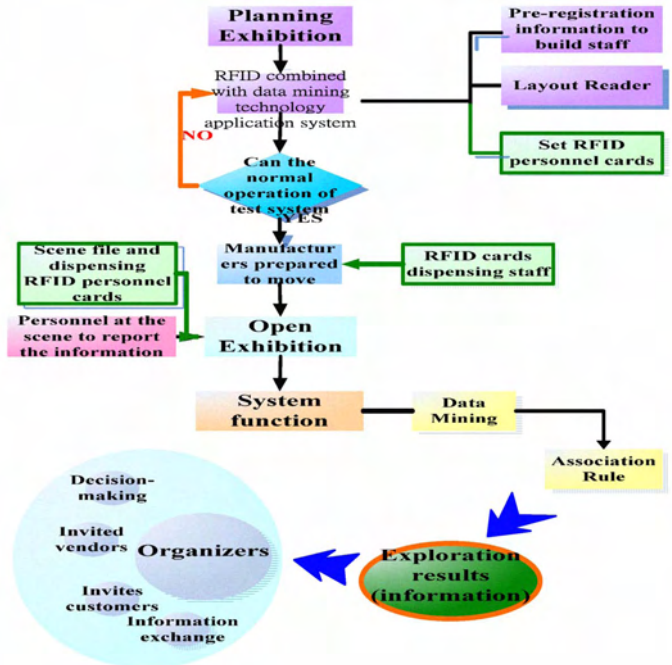

Fig. 4 The construction process of RFID-enabled with Data Mining Model in exhibition
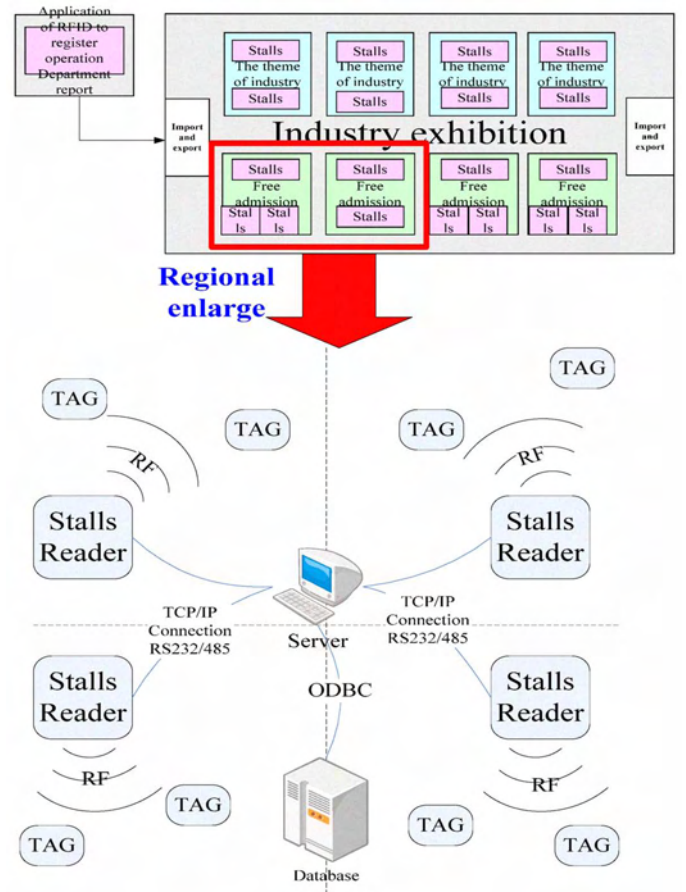

Fig. 5 Exhibition layout of RFID data mining model equipment

In Fig. 5, we describe the exhibition combines RFID data mining model equipment layout, each booth will be set up reading device to collect the visitor to get information.

B. Hardware architecture

The hardware architecture can be seen in Fig. 6. The components include: Reader, Tag (reusable), Server (Host), and TCP/IP network. The show scale determines the amount of Readers and Tags.
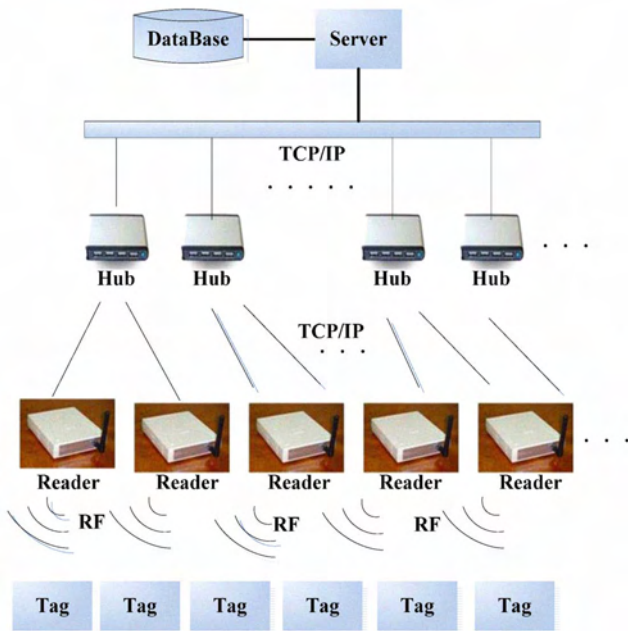

Fig. 6 Hardware architecture

C. Software architecture

Software architecture is part of Microsoft Windows Server 2003 for server software, middleware is derived from LabView to build, and part of the database is derived from SQL 2005 to build. We can see the software architecture in Fig. 7.
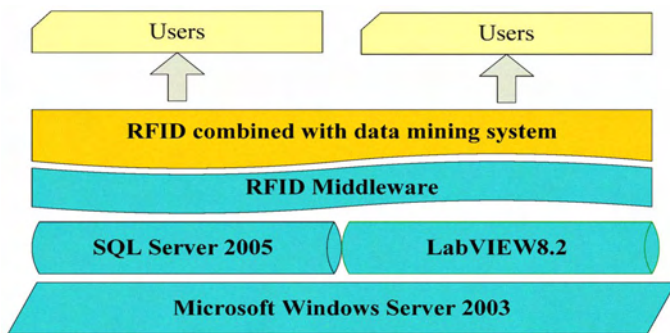

Fig. 7 Software architecture

D. Functions of RFID-enabled with data mining model

Fig. 8 shows the functions of RFID-enabled with Data Mining model. It can be divided into exhibition management,

the application of RFID, industrial exhibition, and data analysis. Its features are:

Exhibition Management:
- Registration system functions: Visitors arrive at the venue can be identified through this system, the immediate effect of RFID tags card to enter the exhibition area, can report back to save operating time.

Application of RFID parts:
- Admission authority classification functions: to provide the theme exhibition fees, free exhibition admission classification authority; VIP, pre-registration, and general visitors, such as classification authority.
- Real-time data collection: through the application of RFID technology will be a large number of complex real-time data collection, and for the use of back-end applications.

Industrial parts:
- Exhibitors industry information functions: We can establish the factory information system in advance, so you know where the factory stand is and what they demonstrate.
- Target audience database functions: Factories can easily collect visitors' information by reading the Tags; they will not have to collect the business card.
- Guests visiting record: Visitors will left visit each booth resume through RFID tags. The records combine RFID data mining system can provide personal to link vendors.

Data analysis parts:
- The visitor real-time data mining functions: In the target audience database, we can see the information visit the curriculum vitae and analysis to find the potential customers and vendors.
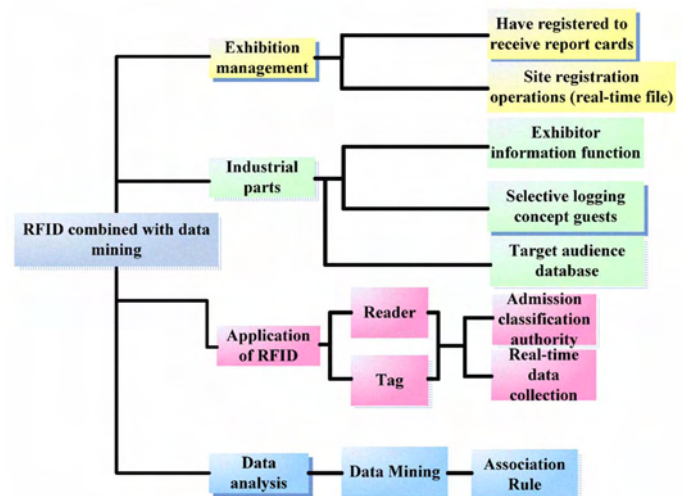

Fig. 8 Functions of RFID-enabled with Data Mining model

IV. CONCLUSIONS AND EXPECTED BENEFITS

In this study, the results and objectives can be divided into the following points:

1） Application of RFID into exhibition industry, the rapid collection and analysis of information on ways to increase the image of the Convention and Exhibition Industry with the Office of Fair performance.

2） Fast reading speed and time saving to solve the traffic of a large number of people in exhibition circulation.

3） On the planning phase, exhibitor and relational customer can link through data mining method. It will increase the performance and scale of the Convention and Exhibition.

4） Successful exhibition may result in unlimited business opportunities in the surrounding industries and job opportunities.

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