ISSN 2616-7433 Vol. 2, Issue 9: 30-36, DOI: 10.25236/FSST.2020.020908

Design and Implementation of Parking Management System Based on Android

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ABSTRACT. *This article gives a design of a parking lot management system based on Android. Combining the Internet of Things RFID technology and IC card technology, through the iData 95 handheld terminal to write specific digital information into the non-contact IC card, call the RFID reader to obtain the data onto the card and do the corresponding calculations, so as to identify personnel and stop Timing charges, data analysis and upload functions. The test works well .Due to the limited space, this article mainly introduces the parking meter system.*

KEYWORDS: *Android, Rfid, Contactless ic card*

1. Introduction

At present, no matter whether it is a parking lot in a shopping mall or a large-scale exhibition center parking lot, a fixed parking lot management system is mainly used, which is far from flexible and costly. Therefore, mobile parking charges had arisen at the historic moment. Take the National Exhibition Center (Shanghai) as an example. Although the parking lot management system in use can be settled on the mobile terminal, the system is based on Windows CE. From the perspective of application maturity and popularity of the operating system, Android is the operating system with the highest market share and the most developed support in current smart phone systems [1]. In view of this situation, this paper presents an Android-based parking lot management system, which improves the flexibility of management. The system design realizes the identification of entering and exiting personnel and the timing of vehicle entering and exiting, which can meet the functions of identifying and checking personnel entering and exiting, the timing of parking of different types of vehicles, real-time data analysis of parking lots, and data upload of handheld terminals.

2. Overall System Design

2.1 System Hardware Design

The Mifare One S50 card used in the system is a non-contact IC card. The non-contact IC card is also called a radio frequency card. It is a new wireless tag technology that has prevailed upon the society in recent years.

The IC card used by the system is divided into 16 sectors, and each sector is composed of 4 blocks, so that the 64 blocks of 16 sectors are sequentially numbered as 0, 1, ..., 63. Here, sector 4 is used. As an example, record the information such as the time of entry and exit from the card. The storage design of sector 4 is shown in Figure 1:

<table>
<tr><td colspan="16">Swipe information, Sector 4, Block 0</td></tr>
<tr><td>①</td><td>②</td><td>③</td><td></td><td colspan="12">Last swipe time, expressed as an integer</td></tr>
<tr><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>0A</td><td>0B</td><td>0C</td><td>0D</td><td>0E</td><td>0F</td></tr>
<tr><td colspan="16">Swipe information, Sector 4, Block 1</td></tr>
<tr><td>④</td><td>⑤</td><td colspan="6">Approach time</td><td>⑥</td><td>⑦</td><td colspan="6">Appearance time</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Fig.1 Sector 4 Information Storage

A complete vehicle entry and exit take up 1 block of information size, and the system sets sector 1 to 4 to record entry and exit. The meaning of each label in Figure 1 is explained as follows:

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①: Record the current entry and exit status. Occupying 1 byte can indicate the state of entry and exit, the design 0x00 means no entry; 0x01 means entry;

②: Number of times of entering and exiting. It is required to enter once and enter one time, occupying 1 byte.

③: The gate number of the most recent entrance. There are 16 gate numbers in the National Exhibition Center, so the gate numbers for the most recent entry and exit are designed to occupy 1 byte.

④: Entry gate number. Regardless of entering and exiting, the gates are all the above 16, so the gate designation of the entrance occupies 1 byte;

⑤: Swipe mode. The swipe card of the National Exhibition Center can be a handheld swipe card or a business center swipe card. The design swipe mode occupies 1 byte. 0x01 indicates the card is swiped by the handset, and 0x09 indicates the card is swiped by the business center. The credit card mode represents the credit card mode when entering the market;

⑥: Exit gate number, designed to occupy 1 byte;

⑦: Credit card mode. This credit card mode represents the credit card mode at the time of appearance. Its design is the same as the entering credit card mode.

2.2 Functional Module

The system mainly implements functions such as operator login, personnel identification, and parking time charging.

Operator login module: If the operator of this system wants to use this system, he must swipe the operator card to log in before using it, to ensure that other people cannot use it at will, so as not to cause unnecessary trouble.

Personnel identification module: The personnel management module mainly realizes the identification of exhibitors. By controlling the RFID reader in the handset to obtain and identify personnel information, and then compare and identify with the database.

Parking time charging module: Through a series of reading and writing operations on the parking card, it calculates how much the vehicle holding the card should charge.

The functional module design is shown in Figure 2:

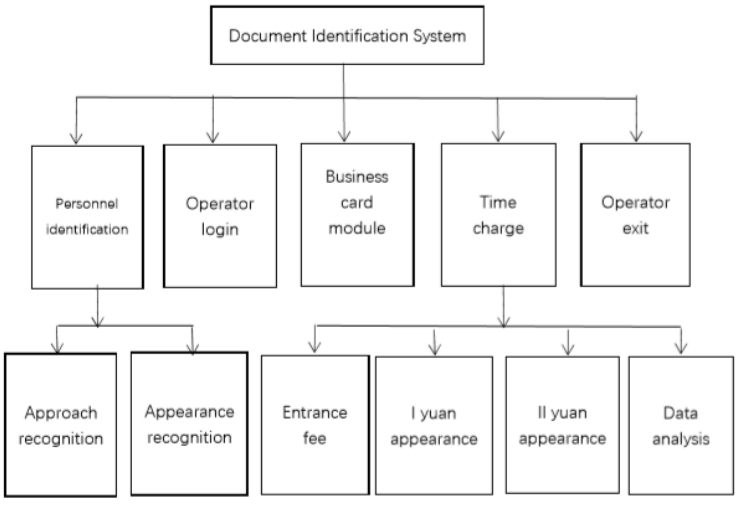

Fig.2 The Overall Functional Architecture of the System

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2.3 System Data Flow

Due to the limited space, this article mainly introduces the design and implementation of the parking metering sub-module. Here, we only take the vehicle's entry and exit process as an example. The vehicle approach process is shown in Figure 3. This function is to record the time when the vehicle enters the field, so that when you leave the field, you will be charged according to the corresponding charging standard.

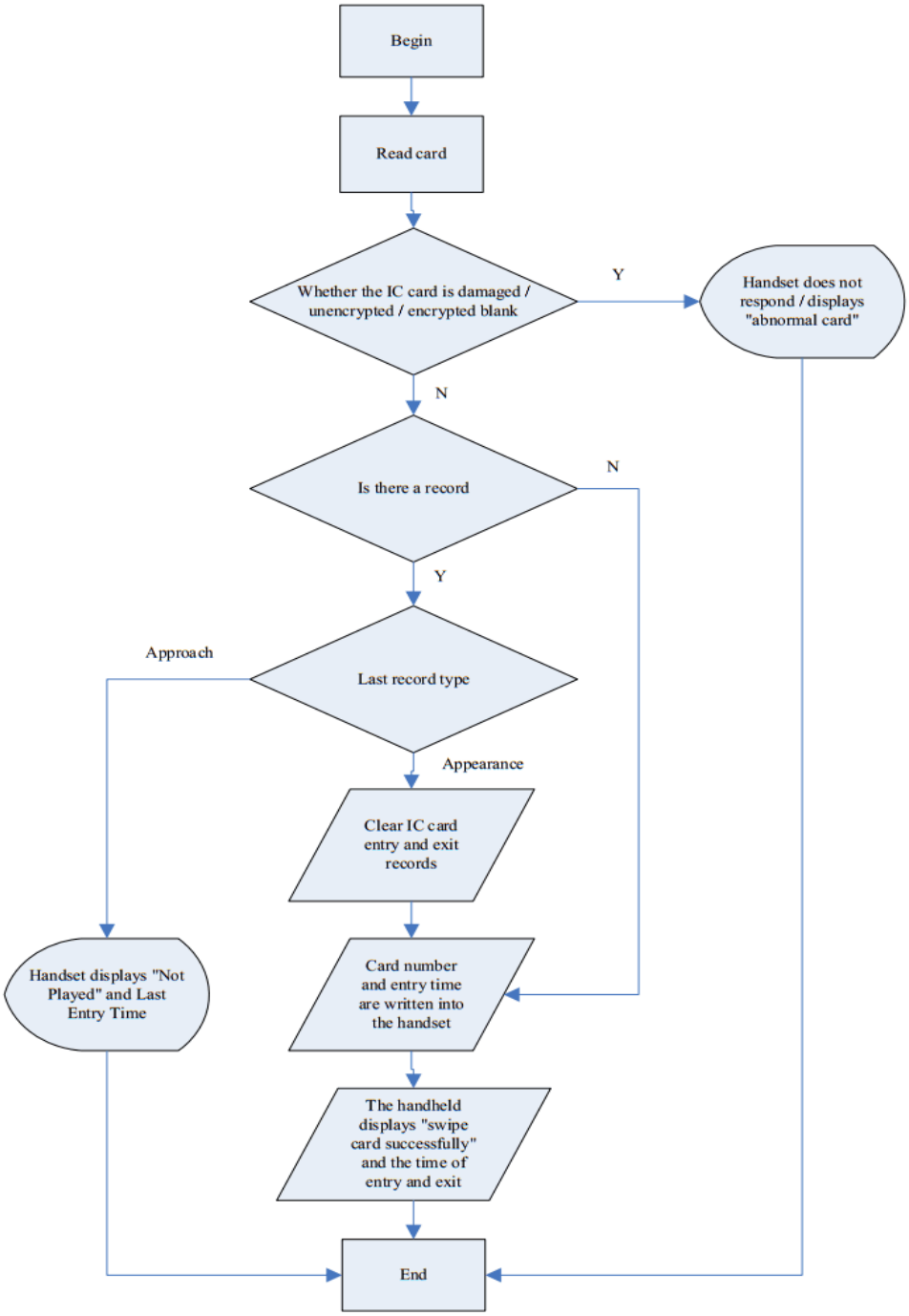

Fig.3 Vehicle Approach Process

There are two types of vehicle appearances. Here, “I yuan appearance” is used as an example. The function module is mainly based on the previously recorded entry time and the current playing time, and performs

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calculation operations according to the I yuan charging standard to charge the parking fee of the vehicle. The process is shown in Figure 4:

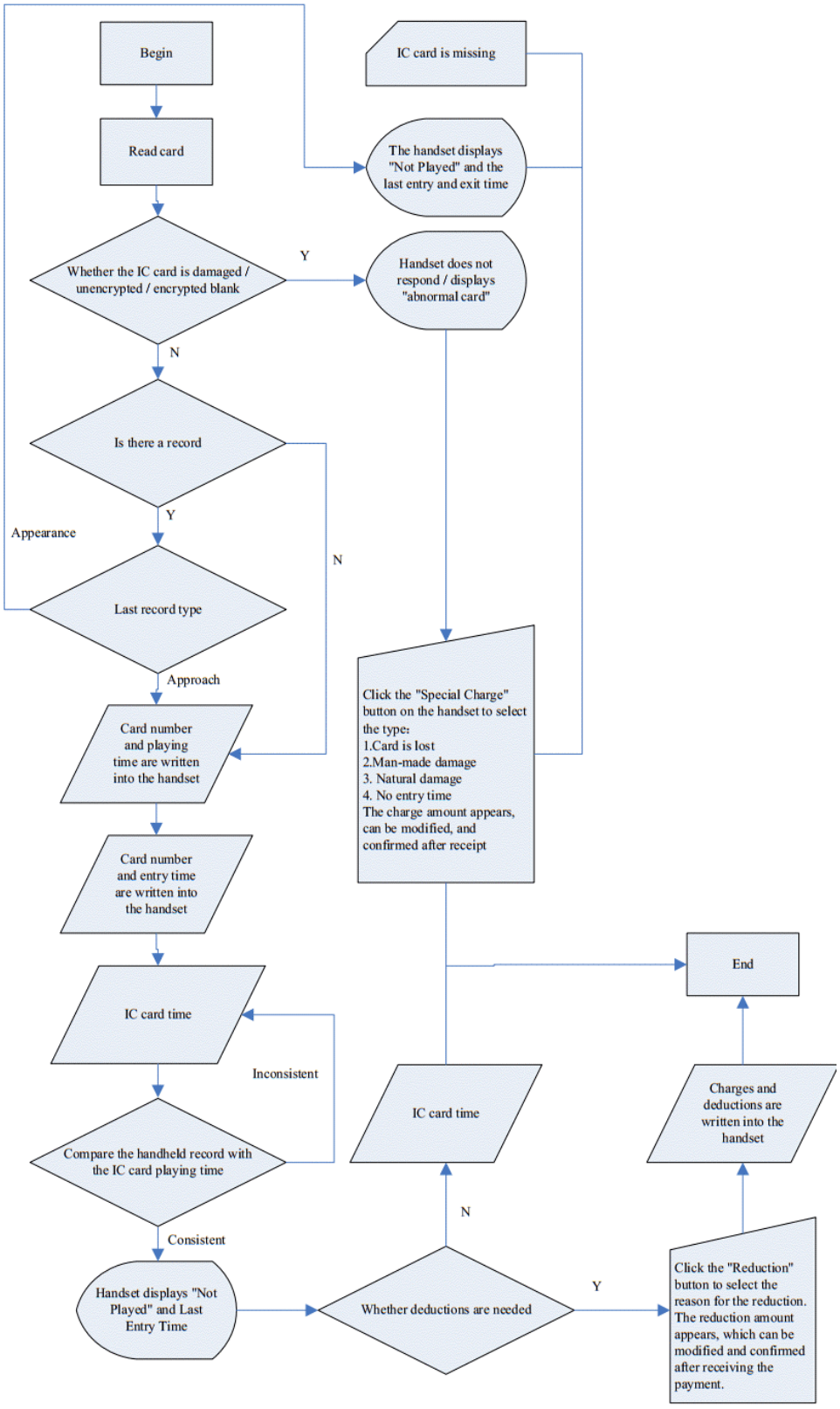

Fig.4 I Yuan Appearance Charge Process

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2.4 Database Design

E-R diagram, also called entity-relationship diagram, is a graphical language mechanism representing data objects and their relationships. It provides methods of representing entity types, attributes, and relationships, and is used to describe the conceptual model of the real world [2]. The system part E-R model is shown in Figure 5 and Figure 6.Because there are many data tables and fields in the system, they will not be explained one by one here.

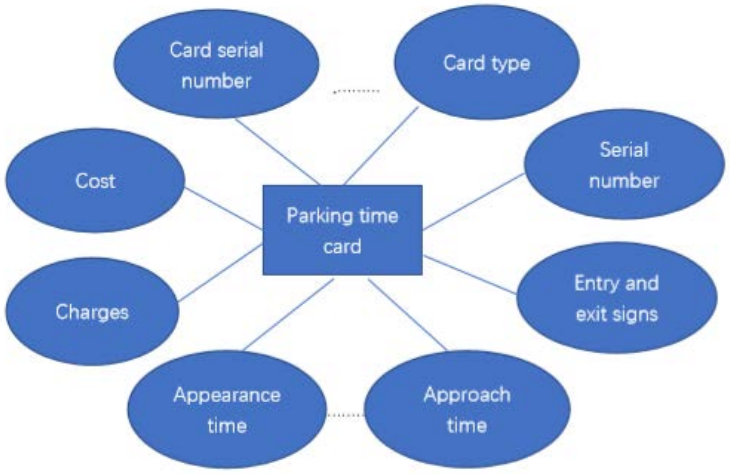

Fig.5 Parking Time Card e-r Model

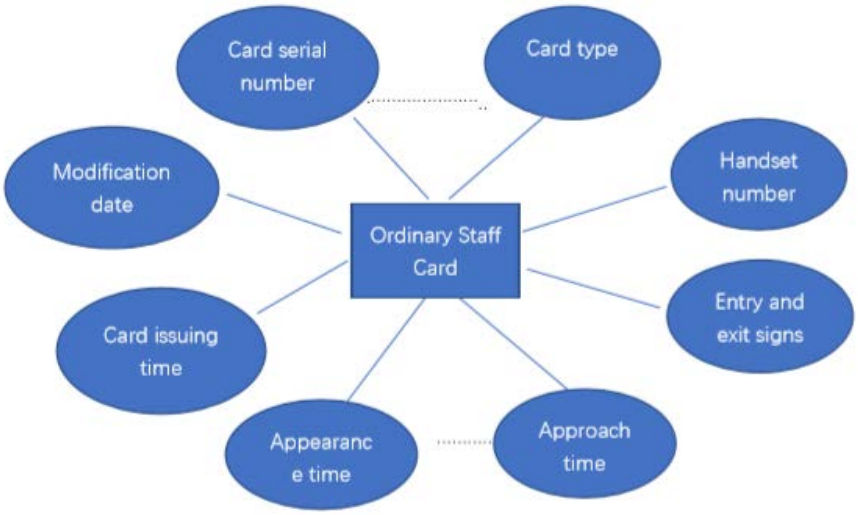

Fig.6 Personnel Card e-r Model

3. Main Functions of the System

3.1 Operator Login

When the operator holds the operator card to swipe the card, the first is to determine the validity of the card, including whether it is damaged or valid, and then to determine the card type. The operator card must be valid

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before other types of IC cards cannot log in to the system. After swiping the card to log in, it will jump to the main function interface, and at the same time, the relevant information about the currently logged in person will be written into the database and saved. Interface and function effect diagram is shown in Figure 7.

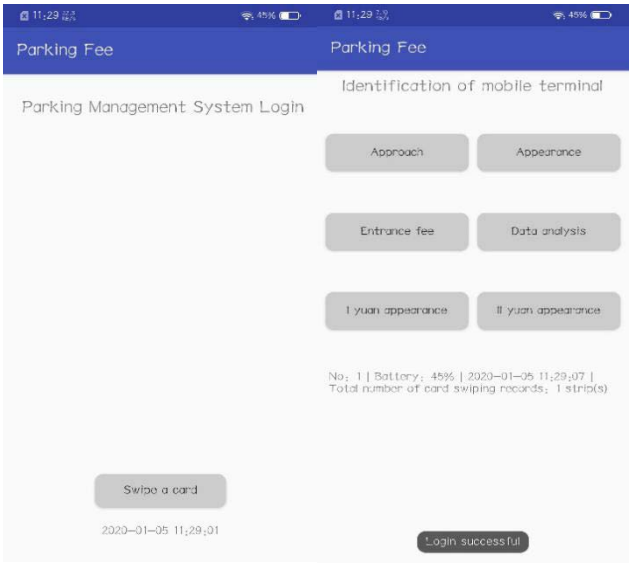

Fig.7 Operator Login

3.2 Entrance Fees for Vehicles

Perform the corresponding operation according to the last record type of the IC card. The IC card records the first entry time, the first entry time, no entry time, and no entry time; the second entry clears the first entry and exit time , No first entry and exit time is not recorded (only the latest set of entry and exit times are recorded in the IC card). The interface layout and function effect diagram are shown in Figure 8.

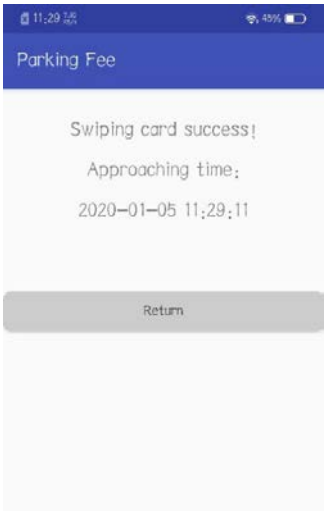

Fig.8 Vehicle Approach

3.3 I Yuan Appearance

On the main function page, click the “I-Yuan Exit” function button to swipe the card. If the vehicle card is invalid, a special charge will be made. According to the last record type of the vehicle card, if it is an appearance, a special charge will be made according to the prompt; if it is an entry , Then write the playing time of the IC card, and at the same time, select whether to reduce or exempt charges on the page that comes out. If you need to reduce the exemption, click “Reduction” and then jump to the reduction or exemption page for selection. Enter

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the amount of deduction and charge, and synchronize the record to the server when this record is online. The page layout and function effect diagram are shown in Figure 9.

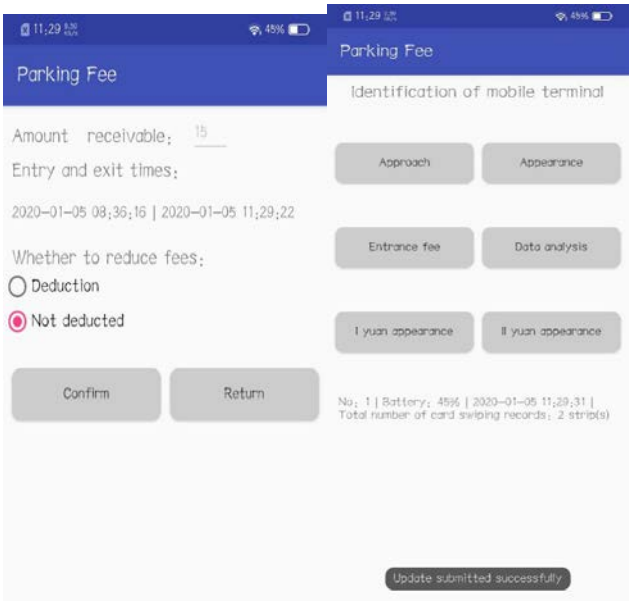

Fig.9 I Yuan Appearance Fee

4. Concluding Remarks

Utilizing the Android platform, and designing and implementing a mobile-oriented parking lot management system with the help of RFID technology and IC card technology. The operator can flexibly hold the handheld device to perform personnel identification and vehicle timing charging at irregular locations, which meets the needs of identification of documents, and adds data analysis functions on the mobile terminal. Each handheld terminal can view the parking lot in real time Happening. At the same time, some functions need to be improved to better serve the management of parking lots.

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