Student Food Data Analysis System

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Keywords: Big data analysis, Embedded system design and development.

Abstract. In today's society where science and technology is rapidly developing, the level of information is increasing year by year, and the canteen needs to change the status quo to provide students with quality food service. Combine the dietary data that can be collected in the canteen with big data to reduce waste and improve the quality of students' diet.

Based on the current situation of the need for student canteens, this paper describes the concept of smart canteen construction, and introduces the i-plates big data analysis system—the system of collecting information based on single-chip RFID technology, python data analysis and computer-side information display; Based on the dietary data, the students' nutrition and health information is generated through data analysis and delivered to students and parents through the webpage, thus promoting the common development of both students and canteens.

Introduction

Research Significance

Big data applications have spread all over the industry, society and even schools. The gap between the original data management theory system and the application of big data industry is increasing [1]. The raw data of some canteen logistics offices retains the original appearance of the data, presents all the details of the data and also introduces a large amount of unstructured data, making the data messy and error messages [2]. In the contemporary world, the network tells the students about the amount of consumption and this information can more fully reflect the large-scale, multi-type, high-speed, low-density characteristics of big data generated in modern higher education management. [3]

The main place where the card is used, the canteen, provides us with a large amount of data, makes full use of the data, and obtains the students’ dietary conditions and consumer prices [4], and analyzes the students’ dietary rules, diet structure and nutritional intake, and other information to improve the diet for students.

Research Content

Using RFID modules for data collection and big data analysis to transform the current school canteens to obtain and visualize student food data, to create a student canteen, including:

(i) Offline hardware device RFID reader RC522+RFID tag for data collection; old-style canteen's card settlement system transformation:

(ii) The server backend uses the mysql database for data storage, and Python + matplotlib for data analysis:

(iii) Dynamic display of data analysis results based on the Raspberry Pi-based website construction and the fontpage as a template.

Design of RFID Intelligent Computing System Based on Single Chip Microcomputer

Demand Function Analysis

Introduction to Functions. The student swipes the plate through the rc-522 card reader module in turn, and the module communicates with the Raspberry Pi based on the SPI, and transmits the ID value in the read RFID tag to the Raspberry Pi. When the dishes are all finished, finally, brush the
student’s card, use this value as the student’s consumption information, and read the Linux time in the Raspberry Pi. Save this information in .txt format on the Linux system of the Raspberry Pi, and wait for the next step.

**Functional Flow.**

**Technical Realization**

(i) SPI interface communication principle: The host is responsible for generating (controlling) the SCK signal - the master-slave communication clock. The following is the timing of the SPI line operation.

Read Byte Data: Host Write Address---The MSB bit of the data byte address to be read first is placed on the MOSI pin until the LSB bit is sent. When SCK=1, the RC522 module obtains the MOSI pin value as one of the addresses. Bit, when SCK=0, RC522 is ready to read the next address; the host reads the data---after reading the address, it can start reading the MISO pin data, first read the level from this pin as the MSB bit of the data, SCK = At 1 o’clock, the MISO data remains unchanged. When SCK = 0, MISO switches to the next bit value.

Write byte data: It is also to serially write the destination address to the MOSI pin, and then serially write data to the MOSI pin. The MSB bit is the start transmit bit.

(ii) This product uses a high frequency RF card reader module with a working frequency of 13.56MHz, which is suitable for detecting electronic tags in a small range. However, in order to read multiple electronic tags at one time, multiple card reading modules are used together. The SPI communication protocol is adopted between the card reading module and the host. Since the SPI communication protocol is a full-duplex three-wire synchronous serial peripheral interface, a plurality of card reading modules are combined by using the connection mode as shown in the following figure:

![Figure 2. Card reader module connection.](image)

Wherein, the SDK pin in the card reading module is connected as a chip selection signal to the general IO port of the host, and the chip selection signal is turned on in turn, so that each card reading module reads the ID value of the electronic tag in a fast and alternate manner, and reads The value obtained is temporarily saved as a .txt file. Because the ID value of each electronic tag is unique, but there is also a case where the same tag is read by multiple card readers, when there is no new ID value after multiple rotation readings, The read data is filtered to clear duplicate ID values. The filtered data is saved again as part of a student’s dietary data.

Let the price be $P_n$ and the dish be $ID_n$, then calculate the total price according to the formula:
\[ P = \sum_{n=1}^{k} P_n \cdot ID_n, \] and save it as part of the diet data.

Data Analysis

Main Content of Data Analysis

After the hardware collects the data, it sends it to the server. Through the analysis of the collected data, the canteen management and sales analysis are provided to provide students with nutrition analysis and food recommendation analysis.

Sales Analysis. The sales analysis of canteen dishes includes analysis of total sales volume and single sales volume, the total sales volume refers to the amount of all dishes sold in the canteen dishes per unit time (days), according to the time point of collecting data, the correlation can be used to distinguish the peak state of students dining in the cafeteria.

The sales volume of a single product refers to the sales volume of a certain dish in the canteen in unit time (days). The amount of dish sold can be related to the popularity of the dish among the students. According to the sales volume of the dish launched in the cafeteria on the same day, the proportion of a certain dish in the canteen menu is appropriately reduced, or the dish is deleted from the menu to reduce the waste of food caused by the unpopularity of the dish.

Some dishes sales visualization code is as follows:

```python
bar = Bar(title=dbmessage["date"],subtitle="今日最热",subtitle_text_size=17)
for num in range(len(times)):
    dict_one = echarts_bar.subtitleone_hot(num)
    value.append(dict_one["maxvalue"]*10)
    attr.append(dict_one["maxkey"])
bar.add("",attr,value)
```

Nutritional Analysis. The nutrition analysis is mainly for the main ingredients of the specific dishes. Facing the same dishes, extracting the most valuable parts in the recipe, such as potatoes, eggs, tomatoes, and beef, as the basic elements for analysis. To explore the nutritional analysis of individual dishes and the nutrient content of the students' time and diet, the purpose is to give students a direction to understand their nutritional intake from the perspective of nutrition.

Based on the main items of the dishes, the nutrient content of the dishes in the unit weight (g) is analyzed, and the dishes highlighted in a certain aspect (protein, fat, sugar, vitamins, trace elements) are classified to provide recommendations for the dishes. in accordance with.

The nutrient analysis of the diet per unit time refers to the extraction of the nutritional analysis of the food consumed by the students in unit time (days), and the cumulative results obtained by the average weight (g) of the canteen are accumulated, which can be selected by the students in the unit time. The nutritional status of the food. At the same time, it compares with the amount of nutrients required by adults (differentiation) for one day, and obtains the results of the analysis of dietary nutrition status of students.

Part of the judgment of the student diet status source is as follows:

```python
if "警告!" in subFIN:
    if(subtitles["推荐"][0]!=[]):
        for one in subtitles["推荐"][0]:
            subFIN += ("推荐减少食用 " + one)
    if(subtitles["推荐"][1]!=[]):
        for one in subtitles["推荐"][1]:
            subFIN += ("推荐增加食用 " + one)
```

Data Processing Related Technology

(i) HBase: Open source non-relational distributed database with certain fault tolerance, high
reliability and scalability. The main application scenario is real-time random read and write of very large-scale data.

(ii) **MapReduce**: A distributed computing framework designed to compute massive amounts of data in parallel.

**Result Display**

![Figure 3](image3.png)

Figure 3. Number of staple food, meat and vegetables for breakfast, lunch and dinner.

![Figure 4](image4.png)

Figure 4. Daily nutritional intake.

**Data Display on the PC Side**

**Implementation Technology**

**Website Function.** Students can log in to check their daily consumption status and specific nutritional analysis results by registering their account on the website, get the information of each canteen food, and monitor the sales volume of each restaurant in the popular recommendation canteen.

**Technical Description.**

(i) **PHP**: Dynamic website development

(ii) **Dreamweaver**: Design interactive web pages

(iii) **XAMPP (Apache+MySQL+PHP+PERL)**: Website integration package

(iv) **jQuery Technology**: Get document elements quickly, provide beautiful page dynamics, create AJAX without refreshing web pages, provide enhancements to the JavaScript language, enhance event handling, and change web content.
Website Structure Design.

Figure 5. Website structure design process—front desk.  

Figure 6. Website structure design process—background.

Conclusion

The construction of student canteens is an important part of the school's logistics work. This paper first proposes a new concept of using the data available in the student canteen for nutrition analysis and visualization of students. The techniques involved in the paper include big data analysis, and the use of website construction technology to visually manage students and canteens. This research can make up for the lack of research on the eating and living patterns of schools in China. Let more students and parents have a deeper understanding of the student's access to the seven major nutrients in protein, fat, carbohydrates, vitamins, mineral water and fiber [7].

This study is mainly aimed at research in Southwest University for Nationalities, and the extensiveness of other regions has been limited. The next step is to make different program improvements for different schools across the country, expand the access to data, get more data analysis conclusions, and conduct differential analysis to find out the differences and commonalities of different schools and establish a wide range of student diet databases.

Acknowledgements

This work was supported by the SMU Student Innovation Training Program (S201810656008).

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