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A Study on the monitoring system of undergraduates' running exercise based on Android platform

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Abstract. In order to better arouse the students' enthusiasm of extracurricular exercise, use asp.net+sqlserver2008 development tools and design a daily running exercise monitoring and management system for college students based on campus WLAN and Android platform technology. The students use this system to collect the relevant movement data through the mobile phone APP while running, the qualified data are uploaded to the server database through the campus WLAN, and the background management software carries on the pooled analysis of the data; The system manages the students' daily running exercise by issuing exercise times and comparing the degree of task completion. The system has a good effect in the practice of students' extracurricular physical exercise management. The design and implementation of the system can provide a new thought and method for the students' daily exercise management.

Introduction

With the continuous decline of the students' physique in our country, many colleges and universities have adopted the measures of "card swiping system for running exercise". Under the condition that college students generally lack of exercise habits in our country, the practice of "forced running" has undoubtedly played an important role in improving students' physique, especially to enhance the endurance. However, due to the limitation of software and hardware, many colleges and universities have many problems in concrete implementations. For instance: ① It needs to invest a lot of money in hardware construction and full-time staff on duty; ② Students need to swipe the card in a fixed time and place while exercising and long-term waiting phenomenon may occur due to concentrated swiping; ③ Students are not free to choose their exercise time; ④ Card swiping has only a single function of attendance, the effect of student exercise cannot be supervised, and the effectiveness of the exercise is still blank; ⑤Students are generally passive about it with many disputes. How to adopt a more scientific and effective new method easy to be carried out, improve the current problems encountered in the daily exercise of students, mobilize students' daily exercise and enthusiasm is becoming more and more important, which become an important subject for improving the physical quality of college students in China.

In previous studies on extracurricular physical exercise of college students, the study subject is often specific and clear, and the data is derived from the investigation and empirical evidence, so it has relatively good reference value. The deficiency lies in the fact that the investigation and study on the present situation are mostly focused on the description of the superficial phenomenon, but there is little deep analysis of the causes of the phenomenon, and the research is more practical and the theoretical depth is always deficient. In recent years, most of the related studies are enthusiastic about the construction of evaluation index system, although scientific, systematic level has been significantly improved, there is no substantial improvement and promotion for actual problems of extracurricular physical exercise of college students.

In the relevant studies on the APP to exercise, this kind of study analyzes the present situation and development trend of the related sports APP comprehensively and concretely, and puts forward the corresponding improvement strategies according to the actual sports needs. But most of the study is based on the development of sports industry or the theoretical analysis level of sports communication. There are few concerns about school sports and mass sports with wide involved aspects and many problems. Although there have been many studies to introduce foreign sports APP development experience and strategy as a reference, the real implementation of the sports in

the process of reality development is still relatively few. Although the development scale of domestic sports APP is increasing day by day, the homogenization phenomenon is becoming more and more serious, and the design and development mode of application is largely identical but with minor differences, and it does not reach the expected development level of theoretical study.

This study uses asp.net+sqlserver2008 to carry on the technical development and has designed the campus fitness running mobile phone APP based on the Android platform within campus network scope, which aims to provide a new thought and method for students' daily exercise management.

System structure design

The daily running exercise monitoring and management system for college students consists of two parts: The data acquisition and feedback device (client side) is completed by a mobile phone with WALN(WirelessLocalArea Network WLAN), and the central node (server) is composed of campus wireless routers and server. In addition, running MySQL database server on PC can deal with students' running data synthetically, and can support users' query, statistics and analysis of the data at the same time. The overall block diagram of the system is shown in Figure 1.

Fig. 1 the block diagram for the whole system

Students hold a mobile phone equipped with a system APP upon exercising, turn on the mobile phone with GPS function for no less than 20 minutes of running exercise. The mobile phone will set the effective running intensity based on the student's BMI index, and monitor the running effectiveness through running speed, arm swing frequency. Students' qualified data will be uploaded to the cloud server database via WALN, and managers will manage the data through the computer (PC) management website. Managers can conduct management through issuing students' exercise times in each semester behind the scenes.

System function

Mobile phone client module

The mobile phone client: the system achieves various functions by APP in the mobile.

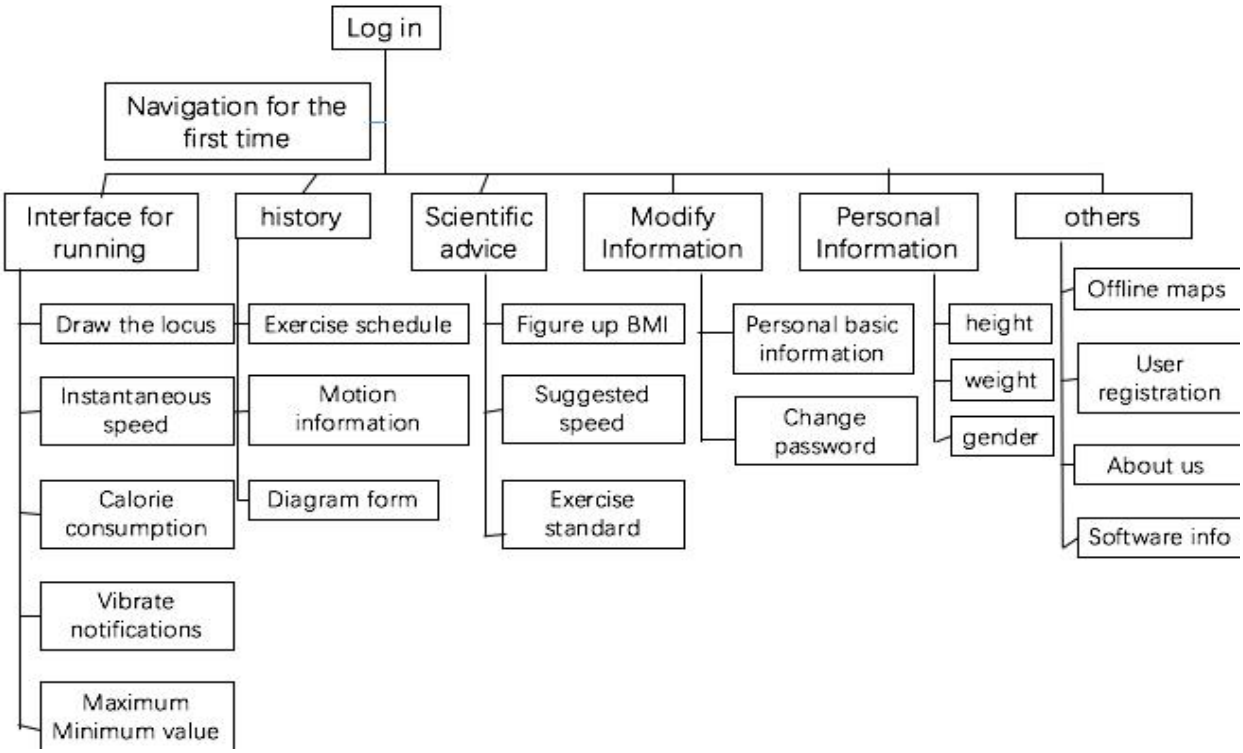

Fig. 2 frame diagram of mobile phone client

The module of personal information and modifying information

Students input their own student number and log to databases. The system ensures the BMI index by student's gender, sex, height and weight which are typed-in when students input for the first time.

The module of running interface

It's a screen display interface when students run. The system displays current motion track., exercise mileage for this time, exercise time, the calories burned, total exercise times, maximum speed and minimum speed, etc. The designs aim to offer comfort required information timely, and give shaken tips when exercise intensity (running speed) does not meet the requirements.

The module of history record

The data will be recorded automatically and saved into user's documents after users finish running, and then generates exercise log according to running records for many times. The log includes line charts for monthly exercise times which put weekly exercise times as display conditions and histogram for daily exercise.

The module for scientific suggestion

This module provides different BMI index which corresponds to the speed which should be achieved for effective exercise, helps students to grasp reasonable amount of exercise.

The others

This module prompts users that they can download offline maps and information about developers. It's convenient for students to feedback timely when the problems appear.

The module of management functions on PC

Administrators at all levels achieve management functions to system data by computer-side

website. The website works as a backstage for motion monitoring systems which take many responsibilities such as querying data and data processing. Administrators need to monitor and analyze data on the website. On the other hand, the website as a backstage also turns on the function of data interaction with mobile terminal. The management system includes five modules which are mutually independent. It is department information, class information，student information, personal information and administrator login. The users can query data and manage accounts by the five modules.

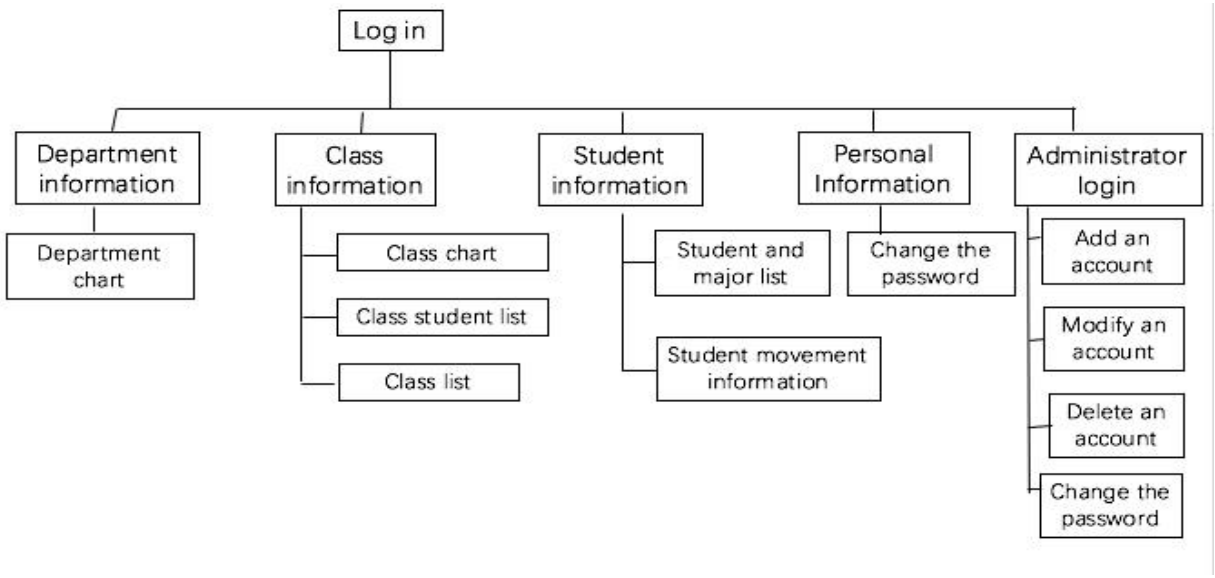

Fig. 3 the block diagram for PC

The module of administrator login

The system can make the differences of school administrator, department administrator and physical education teachers acceding to different permissions. They have the right to manage data of the whole school, the department and their coaching class.

The module of personal information

It is convenient for physical education teachers or administrators to set passwords.

Department information:

It is convenient for the school to summary and analyze the exercise situation of the students from different departments in school.

The module of class information

It is convenient for the departments to summary and analyze exercise situation of the students from different classes and majors.

The module of student information

It’s convenient for students to check and analyze their exercise situation.

Fig. 4 student sports management system schematic diagram

Design of key indicators of system

Selection of effective heart rate for college students' running exercise

According to the age and physiological characteristics of college students in China, 70-80% of the maximum heart rate is chosen as the heart rate target range for running exercise, so the heart rate range of aerobic exercise is 140～160 times/min. according to the formula (maximum heart rate = 220-age) ×[70%～80%].

Determination of running speed standard

According to the difference of BMI index in different gender groups, the students were divided into five groups according to their gender: relatively thin, normal, overweight, fat and obese. A large sample test was conducted in each group. Upon tests, the testers wear the heart rate meter for running exercise and their heart rate is required at 140 ～ 160 times/min for 20 minutes of continuous exercise. On this basis, calculate the running distance and speed of effective heart rate range. In this way, the probability distribution of the distance and average speed in 20 minutes of each group is obtained, and the standards of running speed and distance for college students are determined. The exercise data can only be recorded when the exercisers meet the standards set by the system upon running exercise; if the exercise strength is not up to the standard (such as the slow running speed, too short of running distance), the exercise data shall not be saved and the exercise shall be ineffective.

Limitation to running time and place

Based on movement locus records on the mobile phone, as long as the mobile phone can receive GPS signals, the method is limited by exercising time and place. Students can run and exercise at any convenient time and place to make the exercise more flexible. At the same time, students can exercise offline by simply logging in the system through WLAN before running, and exercise data can be stored in the mobile phone, which can be uploaded to the server when the WLAN signal is restored, so that great convenience is provided for exercisers.

Method design for anti-cheating

The system cheats by comparing the coordinate of movement locus and the arm swinging frequency in uploaded data. Because each runner has a unique running habit and track, even if they are running side by side for 20 minutes, it's also hard to realize that movement locus and arm swinging frequency of two persons are completely consistent in 20 minutes. Therefore, in the system setting, when the running time, GPS track and arm swinging frequency of two persons are completely consistent, the second data cannot be uploaded. At the same time, the system also sets the average number of arm swinging per minute. When the exercisers' arm swinging frequency is in extreme state, it defaults that the exercisers is in abnormal exercise state, which shall be invalid and cannot be uploaded.

Daily exercise and management design

The system sets the number of effective running exercises that students should complete at the beginning of each semester, and summarizes the students' exercise situation at the end of each semester. Different users (school, department, gym teacher) could conduct various operations concerning server data at PC end, so that they can master their daily exercise conditions.

Design of data transmission

The system makes full use of the school network resources and takes the school network central server as the database backstage support. At present, WLAN signal which is widely covered in colleges and universities provides convenience for students to visit and login system at any time.

Students can use mobile phone WLAN to authenticate the identity and log in the campus network for free to achieve the interaction between mobile phone data and the server so that the upload and download of exercise data will not generate additional costs, which greatly facilitates the implement of the work.

Conclusions

The system gives full play to the function of smartphone and integrates with the campus resources (server and WLAN) to construct the monitoring and management system of students' daily running. The school does not need new hardware input, which saves a lot of manpower and financial resources; Secondly, based on effective authentication of students' running time, distance and speed with different BMI, the daily running exercise has a basic standard, so that the effectiveness of exercise has been guaranteed; Thirdly, students can independently choose the convenient time and place for running exercise, which greatly eliminates the students' antipathy; Fourthly, the system provides a powerful hand grab for promoting the development of school sports work and strengthening the extracurricular exercise of students' physical education class.

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