Design and Implementation of Computer-Aided Soccer Training System

Cong Feng¹, Xia Geng²

¹ Department of Physical Education, Jiangsu University
² School of Computer Science and Telecommunication Engineering, Jiangsu University

Abstract

This paper attempts to manage the training information of soccer players with the help of computer. It establishes a soccer training system to administer players’ personal information and the coach’s management information as well as manage the training contents of players. The establishment of the soccer training system achieves the interaction between players, the coach, the fitness trainer and the team manager and helps the coach and the fitness trainer develop scientific and effective training for soccer players in a timely manner, thereby improving players’ performances.

Keywords: computer, soccer training system, management, interaction.

1. INTRODUCTION

With the rapid development of modern competitive sports towards a higher level, modern science and technologies have been more and more frequently applied in soccer training as aids (Yan and Randell, 2005). The soccer tactical teaching and training information interaction system based on remote network services was developed with web and multimedia development tools, providing network remote services (Carey et al., 2001); the soccer tactical awareness assist system was designed based on the soccer tactical awareness forming patterns and in line with the decision-making process of tactical actions (Deliceoglu, 2014), helping soccer players improve their judging and decision-making abilities and tactical awareness in soccer matches.

Every four years, the Football World Cup would spark a craze among soccer fans worldwide, and the unstoppable football leagues in various countries also show the great passion people around the world have for this sport (Malm et al., 2004). Despite the lower-than-expected performance of Chinese soccer team in the world, Chinese people have never diminished their love for soccer (Marcin et al., 2014). As a matter of fact, China has invested a lot in the training of soccer players, but it lacks scientific physical training and management technologies, which has been holding the Chinese team behind.

Training for soccer players involves various contents and subjects (Buchheit et al., 2014), so it is important to maintain reasonable arrangement and record of the training contents for players (Hoff and Helgerud, 2004) and adjust the training plan in time according to their physical conditions (João and George, 2015). Currently in soccer training management, coaches or training partners would usually apply the “one-size-fits-all” method to all athletes and sometimes provide enhanced training for some outstanding players. In terms of training records, they would usually prepare periodic records, which provide only rough information (Jaspers et al., 2016). Therefore, it is necessary to manage the training information of soccer players through computer-aided information technology means (Amir et al., 2001). The soccer training system established with computer technologies can help administer players’ personal information and the coach’s management information (Trigueiros et al., 2015) and manage the training contents of players, thereby greatly improving soccer players’ efficiency and helping soccer teams win matches (Vieira et al., 2012).

2. REQUIREMENT ANALYSIS ON THE SOCCER TRAINING SYSTEM

2.1 Hardware and software environment configuration
In terms of system hardware deployment, the “computer-aided soccer training system” adopts the B/S architecture, of which the background servers include web servers (Ebine et al., 2002), database servers, background servers and other hardware facilities. Users use various functions in the desktop client software system. Details of hardware and software environment configuration are shown in Table 1:

<table>
<thead>
<tr>
<th>Web Server</th>
<th>Apache</th>
</tr>
</thead>
<tbody>
<tr>
<td>database server</td>
<td>Oracle database management software</td>
</tr>
<tr>
<td>background server CPU</td>
<td>2.56GHz</td>
</tr>
<tr>
<td>background server memory</td>
<td>8GB</td>
</tr>
<tr>
<td>background server hard disk</td>
<td>2TB</td>
</tr>
<tr>
<td>system development operating system</td>
<td>Windows operating system</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Desktop Software</th>
<th>Background Server</th>
<th>Client</th>
</tr>
</thead>
<tbody>
<tr>
<td>software operating system</td>
<td>database server</td>
<td>browser</td>
</tr>
<tr>
<td>Windows operating system</td>
<td>Oracle database management software</td>
<td>IE/Chrome browser</td>
</tr>
</tbody>
</table>

2.2 Use cases of subsystems

According to the field survey on the training of soccer players, it was confirmed that the user roles of the “soccer training system” are coach, athlete, fitness trainer and team manager respectively (Ebine et al., 2002). The “soccer training system” helps the coach better record the training status of various players, view their personal conditions, and develop the best training plan for each player at a specific stage according to system calculations and through manual modifications. The functions mainly used by coaches in this system are training plan management, player management, team management and competition management. For the use case of the coach subsystem, please see Figure 1.

![Figure 1. The use case diagram of football coach training system](image)

As shown in Figure 2, athletes use this system to do planning management, training management and personal information management. In training management, there are training record, coach evaluation, appointment for special training and result statistics designed for players. Figure 3 gives a use case of the fitness trainer subsystem. Fitness trainers can help players gain better physical conditions so that they can better respond to emergencies or different conditions during matches. The system is able to design physical training plans suitable for different players and monitor their training results at real time during the physical training process so that the fitness trainer can adjust these physical training plans at any time.
3. OVERALL DESIGN OF SOCCER TRAINING SYSTEM

3.1 Overall system functional analysis of the system

The “soccer training system” has designed management functions respectively for coach, athlete, fitness trainer and team manager based on their work and actual needs (Figure 4). The functions of the system need to provide athletes with are: planning management, personal information management and training management. Planning management includes short-term plan view, long-term plan view, plan modification, plan remaking and special training program management. In training management, there are training record, coach evaluation, appoint of special training and result statistics designed for players. Personal information management is important because the coach will adjust training plans from time to time according to players’ physical conditions. Players should often update their own personal information in this section, and the system is also linked to various physical examination instruments to update various body indexes of players. Personal information management includes basic information management, body index management, diet management and other aspects.
Coaches mainly use training plan management, player management, team management and competition management functions in this system. Training plan management includes basic training, special training, goal setting, special training program and record and evaluation. Team management includes member management and team training plan management, but unlike the player training management, it focuses on the planning, implementation and recording of supporting training contents. The competition management used by coaches mainly consists of pre-match deployment and post-match analysis, and the major function modules include pre-match formation management, post-match training, game records, data statistics and post-match summary, etc.

As the logistic personnel of the entire team, fitness trainers and the team manager are also very important to the players and the team. Fitness trainers can help players gain better physical conditions so that they can better respond to emergencies or different conditions during matches. Players playing at different positions of the field require different physical conditions, and their own personal physical fitness is also a decisive factor to what kind of training they need to attend. Therefore, fitness trainers need to make a lot of effort in design and record. This system can help them design better physical training plans for different players and monitor their training results at real time during the physical training process so that the fitness trainers can adjust these physical training plans at any time.

3.2 Design of database

Entity concepts contained in this “soccer training system” include team, player, coach, fitness trainer, manager, training program, training record and physical training record. The system database model E-R diagram is shown in Figure 5.
3.3 Design of human-machine interactive interfaces

Users of different roles entering their respective main interfaces will get different user interfaces according to the different functions the system provides them with. The main function interfaces of different systems use different operating interfaces. The design details are as follows:

(1) Player subsystem interfaces: planning management, training management, personal information management, short-term training plan, long-term training goals, plan modification, plan remaking, special training program management, training record, coach evaluation, appointment for special training, result statistics, basic information management, body index management, diet management and life management.

(2) Coach subsystem interfaces: training plan management, player management, team management, competition management, basic training management, special training management, goal setting, special training program management, training record, training evaluation, member management, team training program management, pre-match formation management, pre-match training management, game record, data statistics and post-match summary, etc.

(3) Fitness trainer subsystem interfaces: personal fitness training management, player physical condition view and team physical condition statistics, etc.

(4) Back-stage management subsystem interfaces: user management and authority management.

4. DETAILED DESIGN AND IMPLEMENTATION OF THE SOCCER TRAINING SYSTEM

4.1 System topology

Figure 6 gives the topological structure of the soccer training system. The basic hardware of the system adopts the B/S architecture, integrating the background logic processing servers, web servers and database servers. With servers as the nodes, this system is extended to four parts, namely player management, coach management, fitness trainer management and background management.

![Figure 6. Schematic diagram of soccer training system topology](image)

4.2 Detailed design and implementation of functions

Soccer players can log in the system to view the training plans, which include short-term plan, long-term goals and special plan. After entering the system home page, click the “training management” button to enter the function interface of training management. As shown in Figure 7, on this interface, there are three options, namely short-term plan, long-term plan and special plan. Athletes can click each of them as needed to view the
information. On the query result page, athletes can choose to remake the plan or modify the plan.

![Figure 7. The design of soccer player training plan view interface](image)

After viewing the training plan customized by the coach, the soccer player may find some training contents unfit for the training stage where he is at or the whole plan inappropriate due to the coach’s omissions or the player’s outdated personal information; in other words, players may have some suggestions on how to modify their own training plans. Considering this, the system provides players with a way to give their feedbacks on their training plans – any player can propose appropriate suggestions on how to modify his short-term plan, long-term goals and special training tasks, and the system will then give these feedbacks to the coach, who will review the modified plan and determine whether it is fit for this player. Click “training management”. After entering the function interface, click “training plan view”, and then click “modify” to enter the plan modification interface. Except the time frame of the plan, the player may modify the training item, training time, training goals, coach, training intensity and other contents.

In the coach subsystem, it is important to accurately record the training of athletes at real time. Correct records of training contents, time and results will help a coach better understand a player’s characteristics so that he can adjust the player’s training plan in a timely manner, exploit his potentials and make him contribute more to the team. Information about a soccer player that needs to be recorded during the training process includes training start time, end time and duration, body indexes before and after training, detailed training items, training intensity and results, among which, training duration and body indexes are automatically calculated and recorded by the system, and the rest needs to be entered manually by the coach. After completing all this information, the coach can directly save the training record in the system background database. The design of the training record interface is shown in Figure 8.

![Figure 8. Training record interface design](image)
Training goals a coach set for a soccer player are mostly mid- and long-term goals. Sometimes, they also include training targets for a specific match. Giving targeted and directional training for a player can help him achieve better performance. After logging in the system home page with the correct username and password, the coach should click “training plan management” to enter the main interface for player training plan management, and then select the name of the bound soccer player from the drop-down box in the goal setting section, and provide various information including mid-term and long term goals for the athlete according to the system prompt. Data that need to be entered mainly include technical target, physical target and passing skill target, etc. After completing all this information, click “submit” to save the training goals in the system background database. The design of training goal setting interface is shown in Figure 9.

![Figure 9. Training goal setting interface design](image)

A fitness trainer often designs specific physical training goals, tasks and intensities for athletes according to their positions in the field, and at the same time increases or reduces the intensity based on the physical conditions of different athletes. After logging in the system home page with the correct username and password, the fitness trainer should click “physical training management” to enter the main interface of the player physical training management, and then select the name of the bound soccer player from the drop-down box, and provide the physical training goals for the athlete according to the system prompt. After completing all this information, click “submit” to save the physical training goals in the system background database. The design of the personal physical training management interface is shown in Figure 10.

![Figure 10. Interface design of personal physical training management](image)

### 4.3 System test

System test schemes can be divided into white-box testing and black-box testing. This paper adopts functional testing, i.e. black-box testing, which can detect the defects of the system and fully test the features of the system. Details of the system test are shown in Table 2.

---

**Table 2**

<table>
<thead>
<tr>
<th>Test Scheme</th>
<th>White-box Testing</th>
<th>Black-box Testing</th>
</tr>
</thead>
<tbody>
<tr>
<td>System Test</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Details</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 2 System test

<table>
<thead>
<tr>
<th>Test Case Description</th>
<th>Expect Output</th>
<th>Actual Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>User Login</td>
<td>User name and password are correct, successful landing; user name and password error, login failed</td>
<td>line with the expected output</td>
</tr>
<tr>
<td>Training Management</td>
<td>generate training plan</td>
<td>line with the expected output</td>
</tr>
</tbody>
</table>

5. CONCLUSIONS

Within the scope referred to in this study, the conclusions are summarized as follows:

1. Developed with computer network development tools, the design of the soccer training system is feasible in actual soccer training.

2. Based on requirement analysis, the overall design of the soccer training system includes a design data model, a database and a human-machine interaction platform.

3. The basic hardware of the soccer training system adopts the B/S architecture, integrating the background logic processing servers, web servers and database servers. With servers as the nodes, this system is extended to four parts, namely player management, coach management, fitness trainer management and background management.

4. The establishment of the soccer training system achieves the interaction between players, the coach, the fitness trainer and the team manager and helps the coach and the fitness trainer develop scientific and effective training for soccer players in a timely manner, thereby improving players’ performances.

REFERENCES


