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Research Article

Application of Offensive and Defensive Linkage in a Virtual Football Game in the Internet of Things Decision-Making System

Hongtao Chen

School of Physical Education and Health, Yulin Normal University, Yulin 537000, Guangxi, China

Correspondence should be addressed to Hongtao Chen; 20040580@ylu.edu.cn

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Football is a popular sport in the world. Playing football can not only exercise the body and improve physical fitness but also learn some offensive and defensive skills. Football games are popular events all over the world. With the development of science and technology, virtual football games have also become popular. The virtual football game is an entertainment project that combines computer technology and virtual reality technology to analyze the attack and defense relationship in the virtual football game. It can understand the decision-making mechanism and apply the decision-making mechanism to the Internet of Things decision-making system, which will be able to make accurate and fast decisions like virtual players. This is also the content of this paper. This paper proposes a decision system based on virtual football, applies the system to the Internet of Things, and shows that the data of the system fluctuate within 1.5%, that is, the calculation accuracy of the system model is as high as 98.5%, with high calculation stability, high accuracy, and certain reliability.

1. Introduction

The Internet of Things is a comprehensive development technology formed by the integration of multiple disciplines, and its core technologies mainly include AI, sensor technology, radio frequency identification technology, and GPS navigation technology. The development of it and the intelligent system is mainly to simulate the human brain system, nervous system, information system, and behavior system. The improvement of artificial intelligence technology has produced the so-called virtual reality technology. As a realistic embodiment of imitating all human activities, VR has been paid much attention by researchers, and gradually started to study virtual football.

In order to integrate the Internet of Things and virtual football games, researchers need a new object research and development platform. In the process of better scientific research, it can also save research costs. The football game is now used as the research object carrier, mainly because of the inherent combat nature of the team, the individual players' football control ability, the physical confrontation in the game, and the frequent occurrence of emergencies in the game. In view of the characteristics, the virtual football simulation system is produced. The virtual football system mainly refers to the use of virtual reality technology through computer programming to realize the compilation of virtual football characteristics, the transmission of information between virtual players and the control of football in the game. It is a system that competes with the opposing team through cooperation in the virtual arena and wins the game. The application of Internet of Things technology and virtual reality technology in the simulation of football games has important research significance and practical value for the integration and innovation of the two technologies.

The decision-making system is a system studied by the decision theory, which generally consists of three parts: input, output, and internal structure. Its mathematical model describes the state evolution formula and output formula of the research object and reflects the goals required by decision makers. In this way, only after a reasonable objective function is formulated, it is possible to obtain the optimal decision. As a ubiquitous activity of human beings, decision-making is based on a specific object system (decision-making system). This decision-making system

generally includes basic elements such as decision makers, decision-making objects, decision-making information, decision-making theories and methods, and decision-making results. It is the core of the modern scientific decision-making system. It is necessary to study the Internet of Things decision-making system to take measures more efficiently, improve work efficiency, or reduce security incidents.

The innovation of this article lies in the integration of the overall optimization strategy and the individual optimization on the basis of the existing virtual human technology research and decision-making. Therefore, on the basis of the theoretical research, this paper abstracts the mathematical model of the simulation system of virtual reality technology in football games. The model can increase players' enthusiasm for the game and gain a detailed understanding of game strategy decisions. It can well reflect the situation of the real football game and better deal with the emergencies in the game.

2. Related Work

With the rapid development of the Internet of Things technology, many fields use its fast and efficient characteristics to make data decisions. Among them, Pegoraro et al. proposed and discussed a novel DSSE (i.e., adaptive distributed system state estimation) solution that relies on distributed decision points and leverages the cloud-based IoT paradigm. So far, DSSE procedures have used fixed settings independent of the actual value of the measurement accuracy, which is actually affected by the actual health of the network. The proposed DSSE is innovative with respect to previous literature studies in that it can adaptively use the updated accuracy of the measurement device. The information used in the estimation process and the execution rate will be updated as indicated by the appropriate local metrics. These metrics are designed to detect possible changes in the health of the distribution network. Specifically, the variation and variation trend of the rms voltage value obtained by the phasor measurement unit (PMU) is used to trigger the variation in DSSE. If a dynamic change is detected, the measurement data are sent to the DSSE at a higher rate for the estimation process to update the precision values to be considered in the estimation. The proposed system relies on a cloud-based IoT platform designed to integrate various measurement devices, such as PMUs and smart meters. The results obtained on the bus system demonstrate the effectiveness of the proposed method, which is very efficient both in the estimation process and in the use of communication resources [1]. Suryaprakash et al. proposed a human-machine interface through a distance-based fuzzy algorithm that utilizes the user's domain knowledge to construct rules through context awareness and a decision support system. The developed system is based on Linux OS, the algorithms are developed using python and the results are stored on the Internet via FHEM API for IoT application Raspberry Pi *B*+ toolbox and mobile SSH setup using Wi-Fi modem. Using this app, Suryaprakash et al. can be accessed through the home automation system by connecting to the IP address of the web server, and the voice assistance module can also help the patient to control the device through voice control. Suryaprakash et al. believed that this efficient algorithmic decision-making and voice-assisted automation can produce better results in the real world automating things [2]. Early warning systems (EWS) are core type of data-driven Internet of Things (IoT) systems for environmental disaster risk and impact management. Potential benefits of EWS using semantic types include the following: easier plug-and-play of sensors and data sources, simpler, richer, and more dynamic metadata-driven data analysis, and easier service interoperability and coordination. The challenges faced during the practical deployment of semantic EWS are the need for scalable time-sensitive data exchange and processing (especially involving heterogeneous data sources) and the need to be resilient to changing ICT resource constraints in crisis areas. Based on the multisemantic representation model, Poslad et al. proposed a novel IoT EWS system framework to deal with the challenges faced in the actual deployment process. Poslad et al. used heavyweight semantics for the top-level W3C web ontology language ontology model, which describes a multilayered knowledge base and semantic-driven decision support and workflow orchestration. This approach can be validated by identifying system-related metrics and case studies involving a high-level prototype system of semantic EWS (integrated with a deployed EWS infrastructure) [3]. Fukuda et al. attempted to develop a new type of prosthetic control system based on the Internet of Things (IoT) paradigm. The method proposed by Fukuda et al. was able to exploit not only information from the user's muscle activity and prosthetic hand state but also extensive data obtained from objects and objects in the environment. Sensor data can be static features, dynamic states, or even contextual information for operations. The fusion of these sensor data forms a rich information base to support multi-DOF and dexterous prosthetic hands. It is expected that more reliable reasoning and more autonomous control decisions can be developed using IoT-based control systems. The method proposed by Fukuda et al. is validated by a case study using an object with a simple sensor unit and a Myo armband for electromyography (EMG) signals [4]. Data are essential to help decision-making. If the authenticity of the data is low, the choice is less likely to be correct. The Internet of Things (IoT) inevitably involves mistakes, irregularities, flaws, tricks, and model guesswork in big data. Improving data accuracy is critical to addressing these difficulties. Revathy and Canessane summarized the key qualities and difficulties of IoT that affect data processing and decision-making. Revathy and Canessane audited scenarios for estimating and upgrading data accuracy and mining uncertain data streams. Revathy and Canessane makes five recommendations for advancing truly big IoT data surveys in the future. The recommendations relate to the heterogeneity and appropriateness of IoT data, fundamental leadership for autonomy, the idea of developing conscious and regional lean, and data cleansing and processing procedures for IoT. Moreover, Revathy and Canessane proposed edge gadgets and data management methods for protection, customization and security [5]. The Internet of Things (IoT)-

connected societies and systems represent a huge paradigm shift. Siryani et al. proposed a framework for decision support systems (DSS) operating in the IoT ecosystem. DSS leverages advanced analytics capabilities of smart meter (ESM) network communication quality data to improve cost forecasting for smart meter field operations and provide actionable decision recommendations on whether to dispatch technicians to customer locations to resolve ESM issues. He empirically evaluates models using datasets from commercial networks. Siryani et al. demonstrated the effectiveness of his method with a complete Bayesian network prediction model and compares it with three machine learning prediction model classifiers, that is, (1) naive Bayes; (2) random forest; (3) and decision tree. The results show that Siryani et al.'s method produces statistically significant estimates and that DSS will improve the cost efficiency of ESM network operation and maintenance [6]. The research and experiments of the scholars have provided a strong theoretical basis and authenticity for the decision-making of the Internet of Things, but further refinement is needed in the algorithm. This paper analyzes the algorithm based on the attack and defense connection in the virtual football game, and the proposed scheme has practical feasibility, accuracy, and efficiency.

3. Offensive and Defensive Decision-Making Scheme Based on a Virtual Football Game

3.1. Offensive and Defensive Linkages in Virtual Football Matches

3.1.1. Virtual Football Game. When people try to explain a concept, they usually define it with the help of another concept. It is believed that if this way of definition continues, some concepts will be reached eventually. These concepts are so simple and straightforward that there is no other meaning in logic. Observing the proposition that "football is a game", we will find that people's interpretation of football is very consistent with the process of explaining other concepts. If "0" means "football", "1" is "game", if the concept of "game" is still abstract. It must be further explained with the help of the concept of "2" or "3", so that the concept of "football" is more directly and concretely accepted by us. Since "football is a game", the next question is "what is a football game?". Obviously, it is very difficult to directly define the football game. This is largely due to the complexity, dynamics, and unpredictability of processes and outcomes of football games. However, it seems easier to form an intuitive understanding to explain the football game, which involves "what is in the football game". That is, it constitutes what people call a football game. According to different angles, the football game can be composed of two aspects. First of all, the individual player is the basic element of the game. Although the football game is centered on the ball, the decisive factor affecting the process and result of the game is the players on the field. From this point of view, the football game can be decomposed into two parts, the individual and the whole [7, 8]. There are many studies on these two parts. The research on individual ability involves the player's technique, physical fitness, and intelligence, while the overall research mainly covers three aspects: formation, play, and position analysis. The general formation for a football match is shown in Figure 1.

3.1.2. Importance of Offense and Defense. The division of various parts of a football game is the first step that people take in the process of understanding the game, and it reflects people's current fundamental understanding of football issues, that is, football views. Observing any training session, one can clearly see the profound impact of this concept on the training content. A training session is carried out from two perspectives, the individual and the whole. The technical training and physical fitness training in the preparation activities are aimed at improving the personal ability of the players. The tactical coordination drill, formation movement, and group confrontation are the main forms of overall training. However, individual and overall training is always combined with the game scene. A player's individual ability usually refers to a player's ability to handle situations in an offensive and defensive environment. Passing and receiving, shooting, and ball-handling abilities are the reflection of individual abilities in offense. Steals, balls, and clearances are the embodiment of personal ability in defense. Compared with the training of personal ability, the training of overall tactics, formation and play style will inevitably incorporate offensive and defensive elements. The wing tactical training includes both wing attack tactics training and wing defense training. Correspondingly, set-pieces appear in both offense and defense. Therefore, offense and defense are still indispensable factors in set-piece training [9, 10]. Figure 2 shows the tactical arrangement and decision-making in a football match.

3.1.3. Role of Offense and Defense in the Game. Offense and defense are the eternal themes of football games. Some teams advocate offense and believe that only scoring goals can bring the possibility of winning for the team, and some even put forward the view that "offense is the best defense", which fully reflects the importance of offense in the game [11]. Those who hold this opinion can indeed provide convincing evidence, with the data summarizing the rankings and goals and losses of the top three teams in the Europa League for the 2021–2022 season. Table 1 shows the Premier League standings, Table 2 shows the Serie A standings, Table 3 shows the Bundesliga standings, and Table 4 shows the Ligue 1 standings. These data fully demonstrate the important role of offense for the team to win and even win the league championship.

In the 2021–2022 European football season, the champions and runners-up of the Premier League, Serie A, Bundesliga, and Ligue 1 ultimately belong to the teams with the strongest attacking power. The characteristics of Serie A : Most teams have a slower pace, and most teams are not competitive for the championship, but whether it is a strong team or a weak team, they all pay attention to the defensive mode. The characteristics of the Premier League: The competition in the Premier League is more intense year by

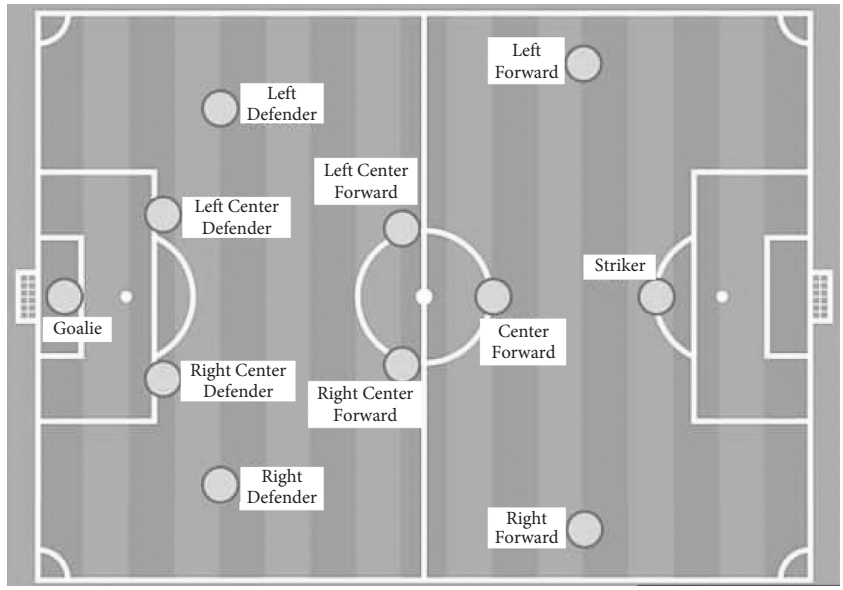
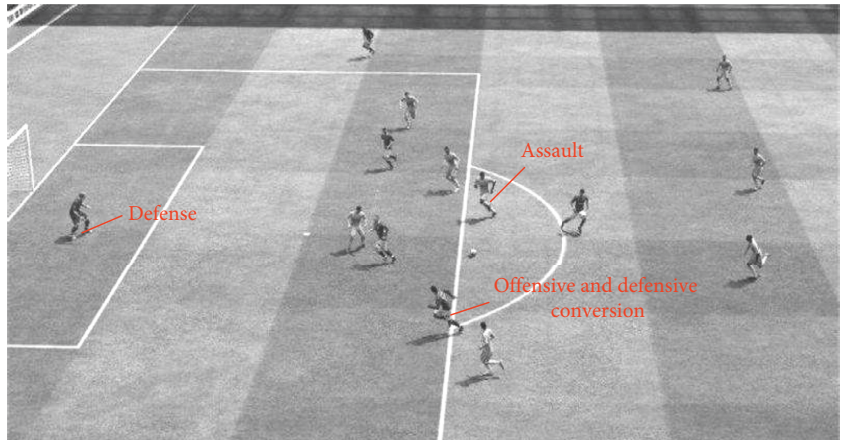
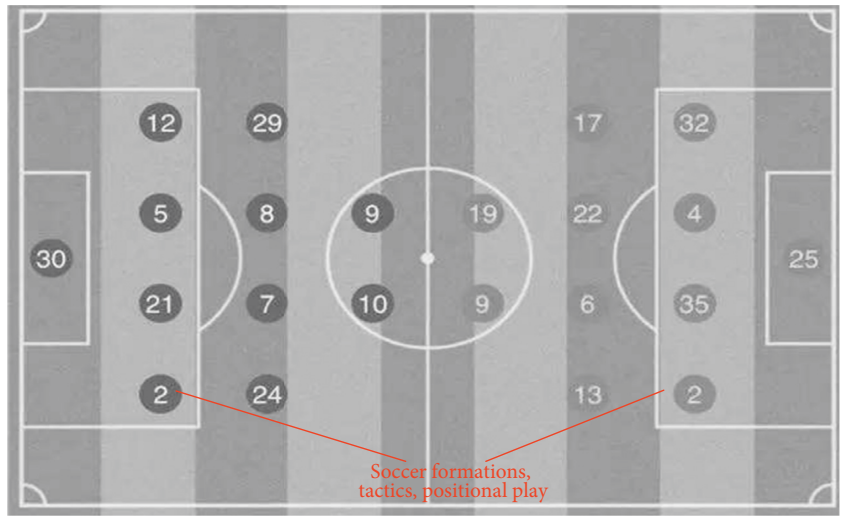


Figure 1: Stadium formation layout.



(a)



(b)

Figure 2: Football tactics and decisions. (a) Moment of football match. (b) Match formation and player placement.

Table 1: 2021–2022 Premier League standings.

Team	Goal	Conceded	Goal difference	Victory	Ranking
Manchester City	63	17	46	20	1
Liverpool	64	20	44	17	2
Chelsea	49	18	31	14	3

Table 2: 2021–2022 Italian Serie A standings.

Team	Goal	Conceded	Goal difference	Victory	Ranking
AC Milan	52	28	24	17	1
Inter Milan	55	22	33	16	2
Naples	46	17	29	16	3

Table 3: 2021–2022 Bundesliga standings.

Team	Goal	Conceded	Goal difference	Victory	Ranking
Bayern Gurney	74	26	48	18	1
Dortmund	63	36	27	16	2
Leverkusen	60	39	21	12	3

Table 4: 2021–2022 French Premier League standings.

Team	Goal	Conceded	Goal difference	Victory	Ranking
Paris Saint-Germain	53	22	31	18	1
Marseille	48	23	46	13	2
Nice	47	21	45	14	3

year, creating more big-name players. The high salary has also attracted many stars, the scene is relatively hot, the rhythm of playing is relatively fast, the mid-to-long distance coordination is relatively good, and the short-range short pass can be used with individual teams. The characteristics of the Bundesliga: Each team is more inclined to the technical flow. With the decline of Bayern's dominance year by year, each team has begun to maintain a certain degree of competitiveness for the championship. At the same time, the referee's law enforcement level is relatively high, and there are few disputes. 's penalty. The characteristics of Ligue 1: Compared with other league teams, Ligue 1 teams prefer to develop their own players. Among them, there are many African players with good skills, but they are not famous. At the same time, the team cooperates with discipline and the organization is not so good, so the scenes are often gorgeous, but there are few goals. And as can be seen from Table 3, the Bayern Munich team in the Bundesliga is very aggressive, scoring 74 goals, 11 more than the second place. This is enough to show that the offense plays a decisive role in the team's victory [12].

It can also be seen from the data that the top three teams not only score the most goals but also concede fewer goals. As shown in Table 1, the number of goals scored by Manchester City and Liverpool is similar. Manchester City scored 1 goal less, but Manchester City conceded fewer goals than Liverpool, and its ranking is higher than Liverpool. This law fully explains the role of defense in the game, and the data of consecutive seasons in Serie A point to this trend, which proves that defense has a significant impact on the process and results of football matches [13, 14].

3.1.4. Offensive and Defensive Contact. Links exist on both ends of the offensive and defensive end. In the moment of offense and defense, contact always has an important impact on both offense and defense. In all situations in the game, one side is on offense and the other side is on defense. From the point of view of the attacking side, breaking the connection of the defending side with the connection between the players of the own side is the key factor for success in the attack. If the attacking side establishes a close enough connection, and the defending side is relatively loose, then the attacking side is likely to take advantage of this advantage to create scoring opportunities [15].

From the standpoint of the defender, a certain scene in the game can also be analyzed accordingly. If the team members are at a disadvantage in the local confrontation, the action to be taken must be to delay the opponent's attack and buy the necessary time for the teammates to establish contact in this area. If the offensive and defensive sides form an evenly matched situation in a local area, the action that the defensive side needs to take is to maintain contact with each other, control the offensive players, and try to cut off the contact between the ball carrier and other players [16].

3.1.5. Establish effective contacts. Usually, players can establish and maintain contact through observation, communication and movement. Observation is the subjective behavior of players to understand the game, and it is the direct way for players to obtain game information. Communication is the main way players exchange information during the game, including verbal reminders and body language expressions. Running is the most basic way a player moves in a game. Almost all coaches are emphasizing the importance of running in the process of competition, and they even believe that active running is the premise of all tactics and the guarantee of team victory [17, 18].

3.2. Internet of Things. The Internet of Things is also known as the "Internet of Everything". It is a huge network formed by the combination of various information detection equipment and the Internet. The goal is to realize the interconnection of people, machines, and things anytime, anywhere. The Internet of Things serves the society with "things" or the physical world as the data source and is a data-centric network. It covers a wide range, including satellite positioning, video surveillance, driving recorders, intelligent identification, education and medical care,

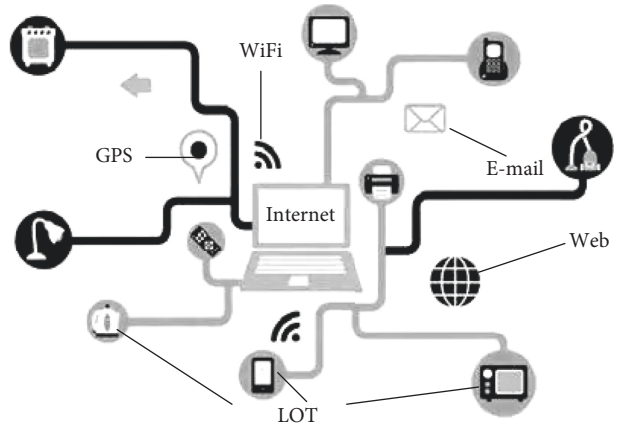


Figure 3: Schematic diagram of IoT concepts.

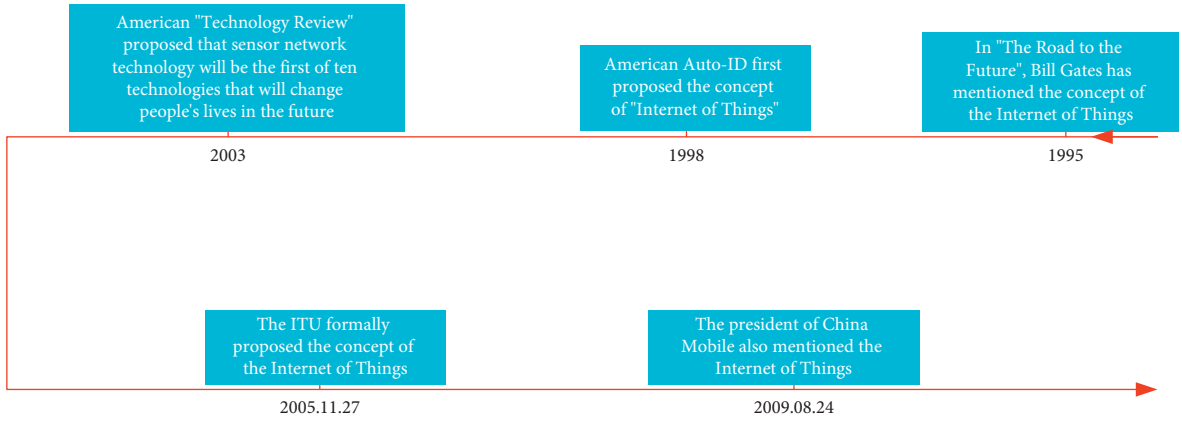


Figure 4: Evolution of IoT.

entertainment and leisure, and many other fields. Its data volume is large, and the current big data include billions of records and petabyte-level data volume. Its update speed is fast, and the Internet of Things big data flow at a speed of hundreds of thousands of pieces of data per second [19]. The IoT data model is usually not one step from IoT devices to big data, but after one or more levels of processing and aggregation, big data are formed, and the convergence point in the middle is called small data. In other words, IoT devices are first aggregated to small data nodes, and then aggregated into big data. Its specific meaning can be shown in Figure 3.

The source and development process of the Internet of Things is shown in Figure 4. From the initial Internet in 1969 to the concept of the Internet of Things in 2005, it has experienced 36 years of development. It has only been more than 10 years since the concept of the Internet of Things was proposed to its popularization. The rapid development of the Internet of Things has greatly facilitated people's work and life.

The key technologies of the Internet of Things mainly include radio frequency identification technology, sensor technology, M2M system framework, and cloud computing. The RFID technology enables items to "talk", which gives the Internet of Things a feature that can be tracked. The goal of the sensor technology is to integrate the acquisition, processing, and execution of information to form a multifunctional microsystem. It is integrated into a large-scale system, thereby greatly improving the level of automation, intelligence, and reliability of the system. M2M is a networked application and service centered on the intelligent interaction of machine terminals, which will enable objects to realize intelligent control. Cloud computing aims to integrate multiple relatively low-cost computing entities into a perfect system with powerful computing power through the network. Moreover, with the help of advanced business models, end users can get these powerful computing services.

The application field of the Internet of Things involves all aspects and is applied in infrastructure fields such as industry, agriculture, environment, transportation, logistics, and security. It effectively promotes the intelligent development of these aspects, making the limited resources more rational use and distribution, thereby improving the efficiency and benefit of the industry. Its application in fields is closely related to life, such as home furnishing, medical health, education, finance and service industry, tourism, and so on. It has greatly improved in terms of service scope, service method, and service quality, which greatly improves people's quality of life.

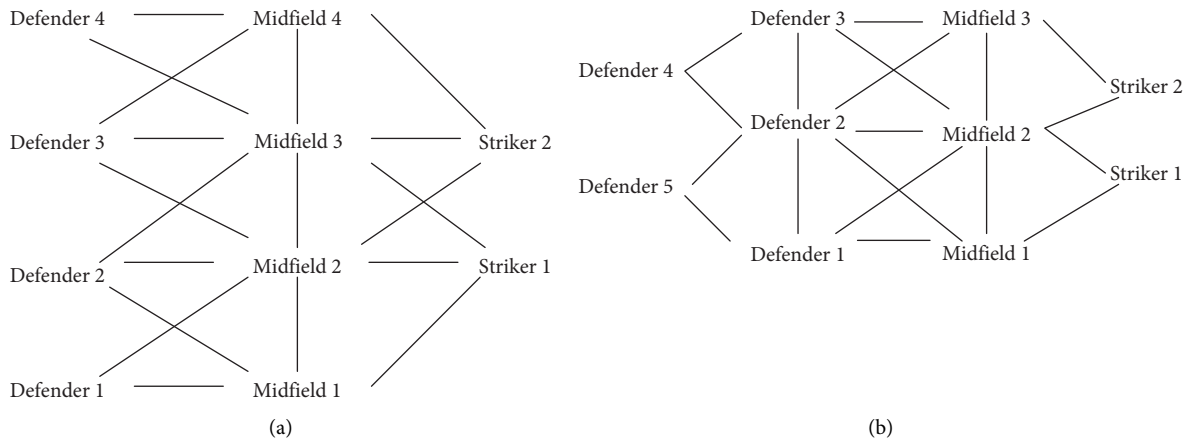


Figure 5: Passing relationship diagram between players of different formations. (a) Classic 2-4-4 formation. (b) 2-3-3-2 defensive formation.

3.3. Decision System

3.3.1. Concept. The behavior of virtual football players mainly includes decision-making and control operations. The behavior and ball-controlling methods of players on the virtual arena are determined by decision-making. The effectiveness of decision-making needs to change according to the situation and real-time changes of the virtual arena. The IoT decision framework provides a structured approach to creating a robust IoT product strategy. The IoT decision framework is about strategic decisions. The IoT decision framework helps users understand where decisions need to be made and ensures consistency across all strategic business decisions, technology, and more. The IoT decision framework is even more important because a product or service that communicates over a network goes through several different layers of technical complexity.

3.3.2. Decision-Making Strategies. For football, its decision-making strategies are divided into low-level decision-making strategies and high-level decision-making strategies. For the team, the high-level strategy library reflects the core strategy of the team. It guides all players of the team to cooperate to implement the formation and tactics in the strategy library, which is similar to the role of the coach in the actual game. The low-level strategy library is to establish different low-level strategy libraries for different player roles, and the different tasks of each role determine the football strategy in the game [20]. Figure 5 displays a diagram of the passing relationship between players of different formations.

3.3.3. Decision-Making Algorithm. The distance and behavior between players are used as the basis for decision-making. Assuming that the distance between the football and the player is dis(ball, player), and the ball control distance is set to CONST_DIST, then when formula (1) is satisfied, it means that the ball control is lost:

$$\text{dis}(\text{ball}, \text{player}) \leq \text{CONST\_DIST}. \tag{1}$$

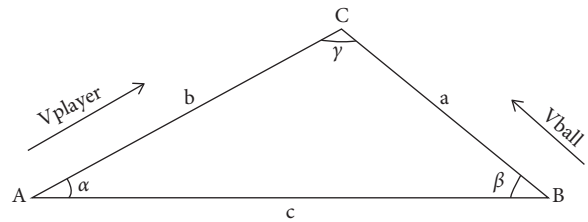


Figure 6: Schematic diagram of players grabbing the ball.

When dis(ball, player) > CONST_DIST, it is assumed that the last three players have possession of the ball, as shown in Figure 6.

According to the triangular cosine law:

$$b^2 = c^2 + a^2 - 2\cos\beta. \tag{2}$$

According to the relationship between distance and speed, there are the following conditions:

$$\begin{aligned} \beta &= \overline{V_{\text{ball}}} \Lambda \overline{BA}, \\ \frac{a}{b} &= \frac{\left|\overline{V_{\text{ball}}}\right|}{\left|\overline{V_{\text{player}}}\right|}, \\ c &= |\overline{BA}|. \end{aligned} \tag{3}$$

According to this, the player who has the earliest possession of the ball and the position of possession can be obtained.

The player movement path can be described as follows:

$$p(t) = a_0 + a_1 t + a_2 t^2 + a_3 t^3. \tag{4}$$

Guidance can be obtained:

$$\dot{p}(t) = \frac{\mathrm{d}p}{\mathrm{d}t} = a_1 + a_2 t + a_3 t^2. \tag{5}$$

Substitute $t = 0$, 1 into the formula, respectively, to obtain:

$$\begin{bmatrix} a_0 \\ a_1 \\ a_2 \\ a_3 \end{bmatrix} = \begin{bmatrix} 1001 \\ 0010 \\ -33-2-1 \\ 2-211 \end{bmatrix} \begin{bmatrix} p(0) \\ p(1) \\ \dot{p}(0) \\ \dot{p}(1) \end{bmatrix}. \tag{6}$$

Then, the expression is as follows:

$$p(t) = \begin{bmatrix} 1tt^2t^3 \end{bmatrix} \begin{bmatrix} 1001 \\ 0010 \\ -33-2-1 \\ 2-211 \end{bmatrix} \begin{bmatrix} p(0) \\ p(1) \\ \dot{p}(0) \\ \dot{p}(1) \end{bmatrix}. \tag{7}$$

Soccer sports model:

$$\begin{aligned} \left(V_x^{t+T}, V_y^{t+T}\right) &= \left(V_x^t, V_y^t\right) + \left(a_x, a_y\right) \cdot T, \\ \left(S_x^{t+T}, S_y^{t+T}\right) &= \frac{\left(V_x^t, V_y^t\right) + \left(V_x^{t+T}, V_y^{t+T}\right)}{2} \\ &\quad \cdot T = \left(V_x^t, V_y^t\right) \cdot T + \frac{1}{2}\left(a_x, a_y\right) \cdot T^2, \\ \left(\left(P_x^{t+T}, P_y^{t+T}\right) &= \left(P_x^t, P_y^t\right) + \left(S_x^{t+T}, S_y^{t+T}\right), \end{aligned} \tag{8}$$

where V is the speed, S is the distance, and P is the position.

If the motion acceleration is ignored in the model, the velocity can be calculated as follows:

$$\left(S_x^{t+T}, S_y^{t+T}\right) = \left(V_x^t, V_y^t\right) \cdot T. \tag{9}$$

The distance the player runs is as follows:

$$S(t) = \begin{cases} 0, & t = o \\ S(t-T) + \sqrt{S_x^{t2} + S_y^{t22}}, & t > 0 \end{cases}. \tag{10}$$

Assuming that the collision distance between the two players is, if the distance is less than this, it means that the players collide and have the same spatial position, that is:

$$\mathrm{Dis}(\mathrm{Player1}, \mathrm{Player2}) < \varepsilon. \tag{11}$$

When the ball-handling player gets the ball, his next step can be represented by the activation function as follows:

$$n_{ij}(t) = \frac{1}{\mathrm{d}_{ij}}, \tag{12}$$

where d_{ij} represents the distance from i to j during the player's travel.

In the process of traveling, the information obtained between i and j is as follows:

$$\begin{aligned} \tau_{ij}(t+n) &= (1-\rho) \cdot \tau_{ij}(t) + \Delta\tau_{ij}(t), \\ \Delta\tau_{ij}(t) &= \sum_{k=1}^{m} \Delta\tau_{ijij}^{\ k}(t), \end{aligned} \tag{13}$$

where ρ is the information disappearance coefficient and $\Delta\tau_{ij}$ is the information increment.

U is used to represent the offensive potential energy of the ball-handling side, U_{art} is used to represent the total potential energy of the arena, $U_{\mathrm{goal}}(x)$ represents the attractive potential energy, and $U_{obs}(\mathrm{x})$ represents the repulsive potential energy, then it can be expressed as follows:

$$U_{\mathrm{art}}(x) = U_{\mathrm{goal}}(x) + U_{\mathrm{obs}}(x). \tag{14}$$

Among them, the attractive potential energy:

$$U_{\mathrm{goal}}(x) = \frac{1}{2} k_p \left(\frac{1}{x - x_{\mathrm{goal}}}\right)^2. \tag{15}$$

Repulsive potential energy:

$$U_{\mathrm{obs}}(x) = \begin{cases} \frac{1}{2}\omega\left(\frac{1}{\rho} - \frac{1}{\rho_0}\right)^2, & \rho \le \rho_0 \\ 0, & \rho > \rho_0 \end{cases}. \tag{16}$$

4. Design and Application of Decision-Making System Based on Virtual Football

4.1. System Design. In the design process of the framework, the overall framework is divided into four modules, namely, entity module, situation module, strategy module, and monitor module. The software structure included in each module is shown in Figure 7.

The situation module state is similar to the entity information on the field such as the physical state of the player and the football path as the main maintenance object. At the same time, the objects monitored by the monitor system are moving objects that can be imaged or animated. Due to the position and moving speed of football and players, it just meets the research object criteria of the surveillance system. It uses the abstract method defined by run() to implement overloading in the entity class. In order to update the motion state of players and footballs, the subclass overloading process is determined according to the motion laws of different research objects. In the state class, each entity instance in the entity module is often used as the reference object, and each entity instance is simultaneously referenced by multiple entities to form the state class. The state class provides a getter to collect the game information of the game through the monitor module. It introduces it into the module interface, in order to keep abreast of the situation on the field, find the collision problem in the field, and make processing decisions in the first time. This needs to establish a separate circuit program in the state class, start the program in the simulated state class, and perform simulated manipulation [21].

The abstract decision maker class used in the strategy module is an abstract form of decision makers, which can provide decision makers with some decision-making information. The execute abstract method it describes must be implemented in all its concrete subclasses. The derived global decision maker class is suitable for the global decision of the actual team, and the individual decision maker class is suitable for a specific individual decision of a player in the game. Due to the differences in the division of labor among players on the field, the individual decision maker divides all players into four categories: Goalie DM for goalkeeper

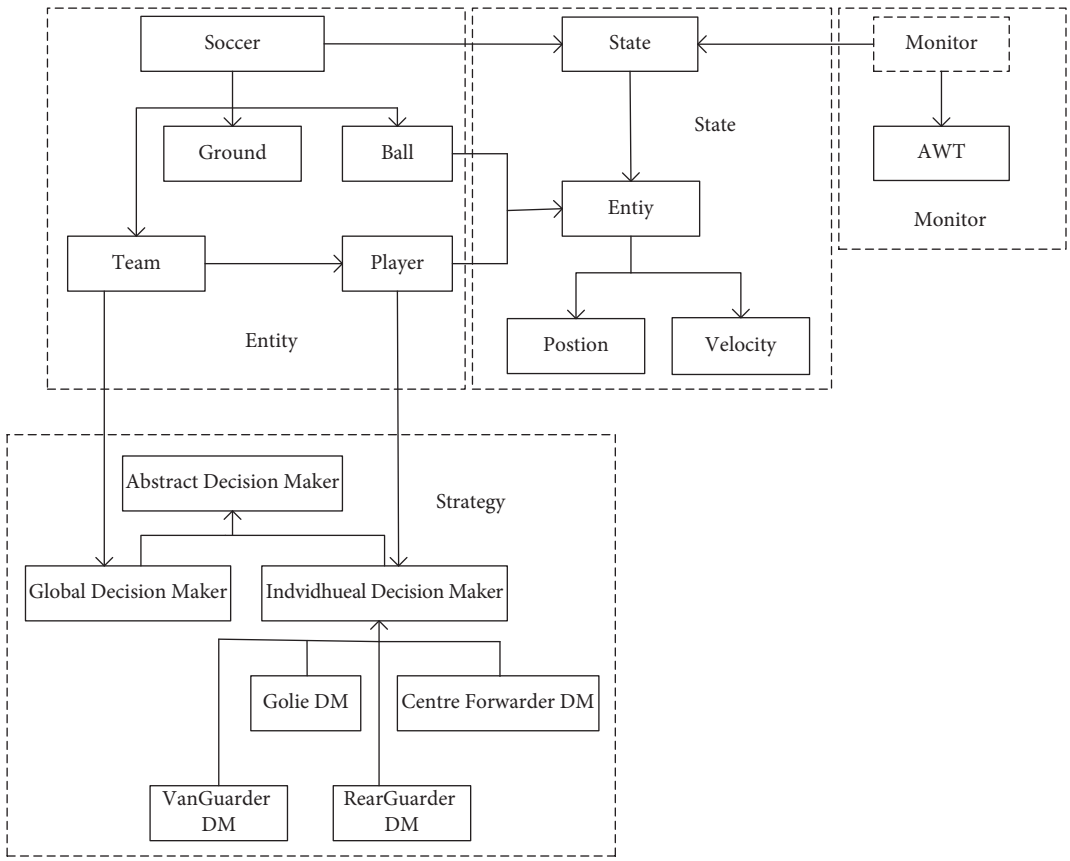


Figure 7: IoT system framework based on virtual football.

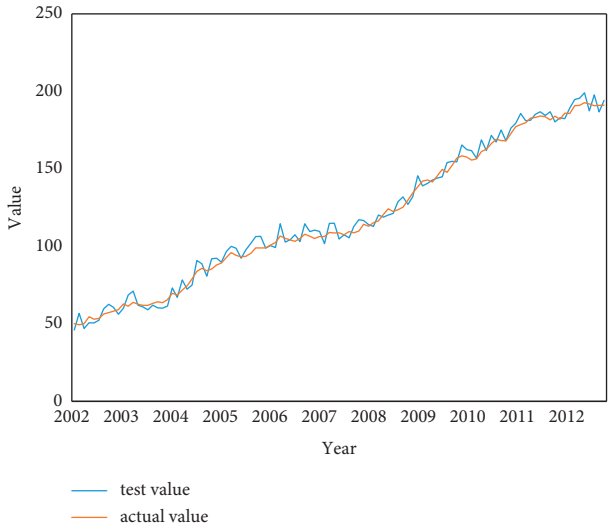


Figure 8: Fit plot of training versus actual values.

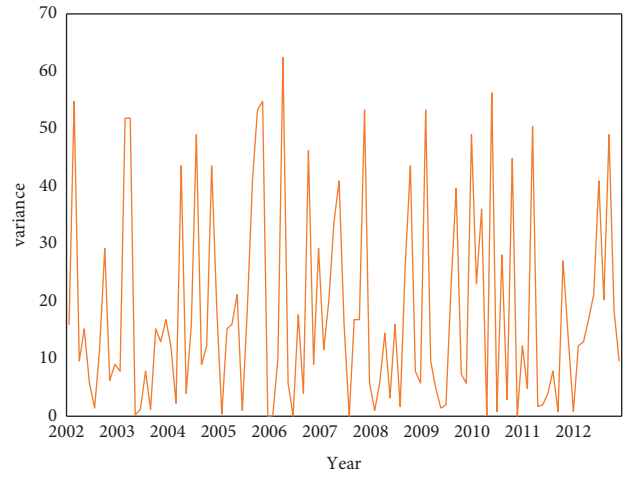


Figure 9: Training error values.

decision-making, Rear Guarder DM for defender decision-making, Centre Forwarder DM for midfield decision-making, and Van Guarder DM for forward decision-making.

4.2. System Testing and Data Analysis. The IoT Decision Framework focuses on six key decision areas in any IoT product. These decision areas include user experience, data, business, technology, security, standards, and regulations. Aiming at the offensive and defensive relationship between players, this paper applies the designed decision-making system to data prediction and processing to make decisions.

In this paper, for an Internet of Things system, we use the designed decision system to predict its data and make corresponding decisions to increase the output. The data volume of the Internet of Things in the past 10 years is shown

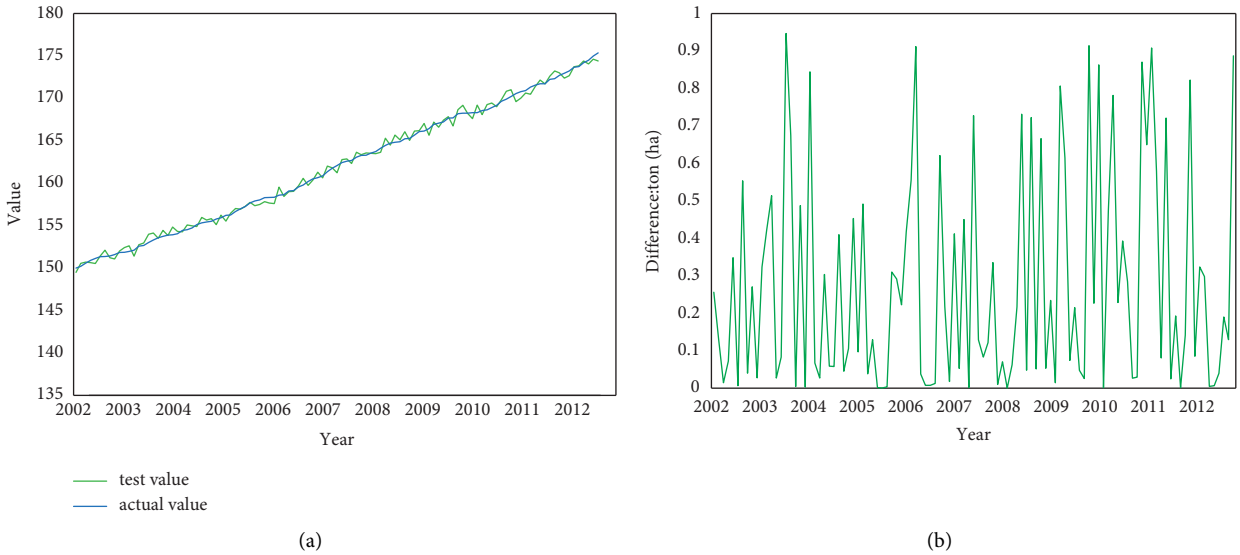


Figure 10: Test results. (a) Comparison of test value and actual value. (b) Test error value.

in Figure 8, and these data are trained to fit the trained and actual values.

As can be seen from Figure 8, although there are still many errors compared with the training data displayed according to the Internet of Things, the two fitting degrees are still quite high, and the overall trend is consistent. In order to understand the error more easily, the error diagram is made as shown in Figure 9.

As can be seen from Figure 9, the magnitude of the training variance values are between 65, compared with the maximum value of 200, and the error is less than 5%, so there is sufficient accuracy after training.

Therefore, this is further tested, and the test and actual results are obtained, as shown in Figure 10.

As can be seen from Figure 10, the final test result fluctuates in the variance value within 1, and the error is not more than 1.5%. That is to say, the calculation accuracy of the system model on the data decision of the Internet of Things is as high as 98.5%, with high calculation stability, high accuracy and certain reliability.

5. Discussion

In order to create a realistic and effective decision-making system about virtual football games, this paper still needs to work hard from the following three aspects:

(1) This paper considers the player's action process during the game, but there is no analysis and research on the warm-up action and physical state of the player before the official start of the game.

(2) In the process of formulating decision-making strategies, this paper only analyzes the actions and thinking of the ball-controlling members in detail. However, this paper does not conduct a detailed study on the activities of other team members. Perhaps, sudden actions such as physical collisions by non-ball-possessing members often affect the progress of the game.

(3) The static formation in the decision-making system is not perfect, and the information in the player's personal strategy database is not clear and accurate, and needs to be further improved.

6. Conclusion

This paper first summarizes the research purpose and content of this paper in the abstract part and introduces the background meaning and some key content of this paper in the introduction part. Second, some scholars' research results on the main content of this paper are listed in the related work part, so as to understand the relationship between the content of the virtual football game and the offense and defense.

In the theoretical research part, this paper first focuses on the attack-defense connection of virtual football games. It includes its virtual football game, the importance of offense and defense, the role of offense and defense in the game, the link between offense and defense, and the establishment of effective links. Second, this paper introduces the Internet of Things, including its concept and development process. Finally, this paper introduces the decision-making system, including its concept, decision-making strategy, and decision-making algorithm.

In the experimental test, this paper first introduces the overall structure of the decision-making system based on virtual football and introduces the particularly important situation module and strategy module in detail. Second, this paper conducts data training on the system according to the collected data of the Internet of Things. After obtaining sufficient training accuracy, the system test is carried out. Finally, the test results are described in this paper with the help of charts. The final result shows that the overall

architecture of the decision-making system based on virtual football in this paper has high calculation accuracy, high calculation stability, and high accuracy for IoT decision-making data, and the system has a certain reliability.

Data Availability

No data were used to support this study.

Conflicts of Interest

There are no conflicts of interest with any financial organizations regarding the material reported in this manuscript.

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