Parallel Training: From Dispersed Training Information System to Intelligent Integration Training Operation System

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Abstract: This paper aims to propose an solution for intelligence training, that is, parallel training operation system based on parallel system theories. It is hoped that the solution can be adapt to modern international Enterprise training with the characteristic of intelligence management and smart operation. The idea of virtual and real interaction has been adopted in this paper. We constructed a new generation intelligence integrated training system by building cyber physical social system (CPSS) that highlights people and their social factors as the infrastructure. Besides, some other process also had been used including of artificial scene, computational experiments, as well as parallel execution, which has been sum up ACP parallel intelligence theory. Taking an training center of large scale as an example, in this paper , first we pointed out the shortcomings for current information systems of training basement and proposed the concept of intelligence operating training system with the function that unified all of resource in logical way. And then, in the application layer of the system, based on the ACP theory, intelligence operating mode with the function of virtual and real interaction had been constructed. By this mode, the aim of closed loop, feedback and precise convergence could be final realized. In the end, with a case study of an real training center, we provided the system design and implementation method, which confirmed the feasibility and practicability of the intelligence operating training system proposed in this article.

1. Introduction

With the development of modern enterprise, the employee training has play an important way for competitive power improvement of the corporation, which result in many large international corporation constructed their own training basement for employees aiming at promoting them to improve the working ability [1].

Although the training classes assorted to the internet with remote-on line teaching method has been widely and successfully used, it still has shortcomings and can not replace the real face to face teaching and practice in real scene. Since the key technique and the skilled operating ability could not be obtained without effective practice. So the real training basement has its irreplaceable function and should be considered as the main spot for employee training.

The problem of how to operate the large training center in more effective way had attracted the interest of many scholars in this area. In recently years, they acquired some solutions such as using information system instead of handwriting checking, applying a QR code scan technology with mobile phone, assorting to commercial software for statistic [2]. However, with the time progress as well as development of technology, there have been more and more information systems congested in our daily work. And it is hard to effectively integrate the data and applications in those different systems. Therefore, the aim of efficient training have not been achieved.

In order to solve this problem, in this paper, the intelligence operating training system with virtual and real interaction function, based on the idea of parallel theory which included artificial scene, computational experiments, and parallel execution had been founded. Via the mode of unified management, combining the ACP and CPSS theory, the new system can realized unified operating by modeling the training basement, participants, as well as the training processes. As to

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the particular problem, according to the predicting intelligence, we can choose the optimum strategy and play parallel execution, that is , taking the computed optimum strategy to both real and artificial system, to realize the instructing intelligence.

2. Parallel System and Parallel Control Theory

The parallel system first proposed by Wangfeiyue in 2004, which consisted of a real system and the corresponding one or more artificial systems [3]. It is essentially that the method we used today, such as mathematical modeling, computer simulation and virtual reality , could be considered as the example of applying the parallel system method in designing ,analysis and control.

Modern control theory were the successful example of applying parallel system theory. The methods in modern control theory such as transfer function, space state, optimum control theory, adaptive control based on the reference model could be considered as the particular method of parallel system. In the following condition, the precise model can be build in the whole time or section with parameter identification, data regression as well as artificial intelligence, so the function of artificial part in parallel system can not be aware.

However, in the complicated scene, it is hard to build the precise model. Furthermore,it could not construct the estimation system model that correctly describes the short period action of the system. In these scene, the artificial part in parallel system should play role in the management and control. The interaction of artificial and real in parallel system has been shown on Figure 1

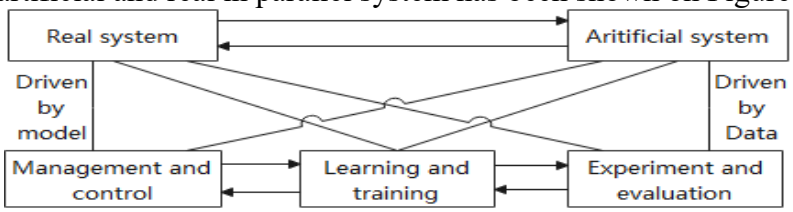

Figure 1 Basic framework and processes for execution of parallel systems.

Figure 1 is the basic framework and processes for execution of parallel systems, which included real system and artificial system. Via their interaction to make the real system much more tend to artificial system, and to realize the complicated control and management. According to this framework, three working modes had been included [4,5,6,7].

- Learning and training. In this mode, it mainly depended on artificial system, with applying data- driven. There may be the great differences between the real system, which don't have to be working parallel.
- Experimenting and evaluating. In this mode, it mainly depended on computational experiments. And the interaction happened frequently between artificial and real system, with the experiments for different strategies and prediction and evaluation of the effect.
- Control and management. In this mode, it mainly depended on parallel execution. The artificial system and real system interacted with each other in real time. To particularly, for one real system, there may be many artificial systems to parallel with.

3. The Feasibility Analysis and Platform Design of Intelligent Integration Training Operation System

3.1. The Feasibility Analysis of the System

Intelligent integration training operation system applied the idea of parallel control theory, to construct the operation system adapted to the future requirement, which has the characteristic of digitization and intelligence. As to the large training center, with the description of all the equipment and involved people, we can build up an artificial system in digital description way, and obtain the optimum result via computational experiments prediction. And then, we can apply the result into the real system and realize artificial and real interaction by feedback. At present, the method of parallel control have been used in many areas such as transportation, chemical industry,

medical treatment as well as safety control. The feasibility in each segment has been verified to some extent. Therefore, this kind of method would also be feasible to training field.

3.2. The Frame and Platform Design of the System

The diagram of classical training information system was shown on Figure 2, which includes interaction layer, data layer and system layer. Multifarious information such as personnel information, training and teaching information, student learning information and so on has been stored in these information systems. However, as the information accumulation and the interaction frequently, different information systems were difficult to integrate, and massive information in different information system lead to data chaos.

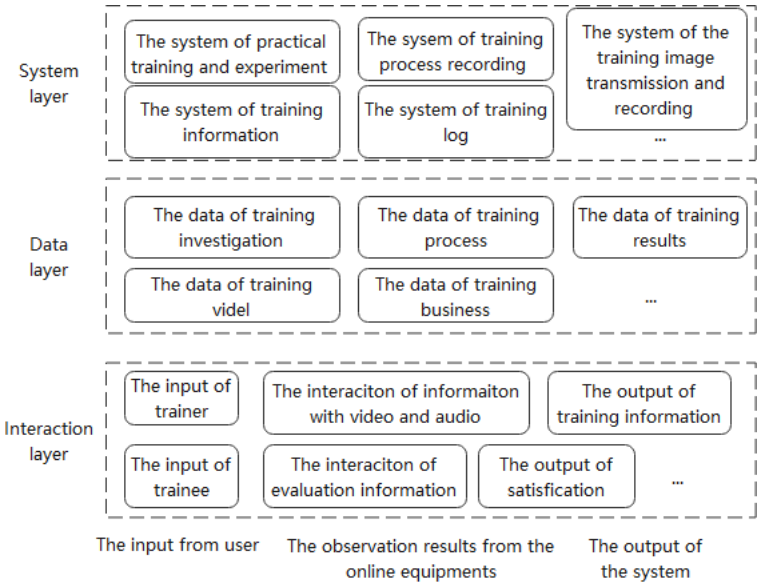

Figure 2 The information system for training.

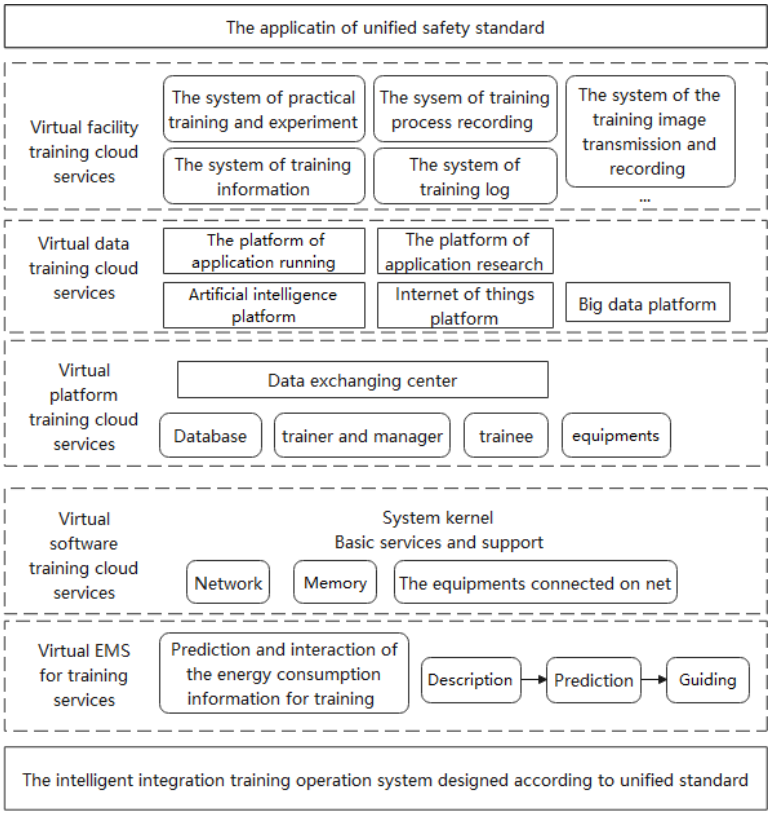

Figure 3 The framework diagram of the intelligent integration training operation system based on cloud computing service mode

In order to solve this problem,an intelligent integration training operation system has been design in this paper, which can realize the uniform control and manage the hardware and software resources, organizing them in a reasonable way providing to users.

This kind of system could combine the device connected in the internet and manage them in an abstract way. It is easy to call and management since it has the uniform interface for the upper software user. The intelligent integration training operation system realized uniform management and provided the data and function support to upper layer users. The intelligent integration training operation system realized the artificial management in uniform way, with cloud computation for bottom layer data. Many services have been design in this system: virtual facility training cloud services, virtual data training cloud services, virtual platform training cloud services, virtual software training cloud services, virtual EMS for training services. The framework diagram of the intelligent integration training operation system based on cloud computing service mode was shown on Figure 3.

3.3. The Composition of the System

The intelligent integration training operation system has been constructed based on the digitalize of the real training processes, with the interaction between the artificial and real system, the optimum strategy has been applied into the system. The framework of realization of the parallel management for the intelligent integration training operation system was shown on Figure 4. with the virtualization of the segment of the training, as well as the involved people, the digital twin training center has been found.

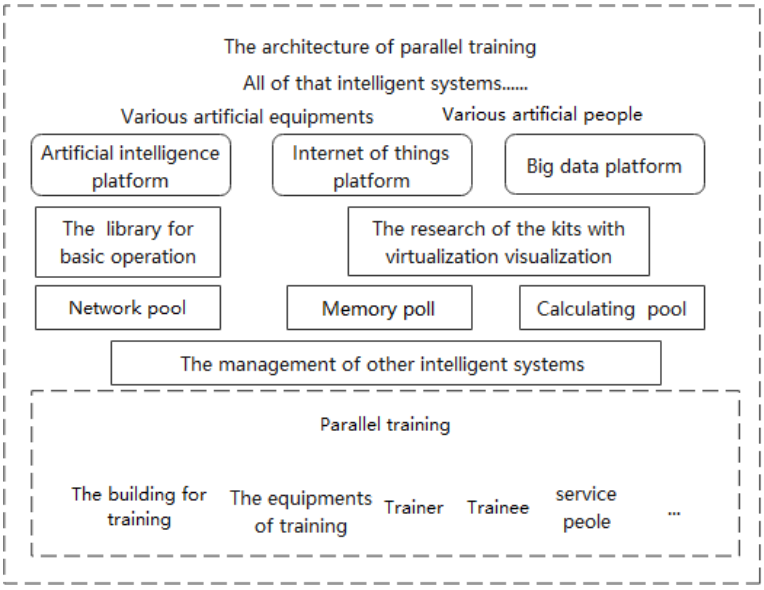

Figure 4 The framework of realization of the parallel management for the intelligent integration training operation system

4. The Realization of the Intelligent Integration Training Operation System

4.1. The Digital Virtualization of the Physical Layer

In order to realize the intelligence operation and management,it is necessary to digitalize the involved things such as the physical equipment, people and so on. We can use the software such as Unity, 3DSMax, Google 3D Warehouse to build the artificial training scene. The digital virtualization of the people involved in the training process. On the basement of the artificial scene, it is necessary to define the involved people. They were artificial coach, artificial trainee, artificial service people, other involved people.

4.1.1. Artificial Coach

Artificial coach is the mapping of the real-world trainer in the virtual space, which included three

states: description coach, prediction coach and guiding coach. Description coach integrated the features of the real coach such as professional knowledge, the experience of teaching, the reasoning ability , the characteristic and so on in the artificial role. Prediction coach can provide the evaluation of the current ability and improving strategies for the trainee, with computational experiments. The guiding coach was a set of optimum state artificial coach, since they had accumulated the experience and been optimized by trial and error.

4.1.2. Artificial Trainee

In order to evaluate the ability level of the trainee in a much better way, it is necessary to build the ability model of the trainee. So the artificial trainee model has been found. The constructing of the artificial trainee based on simulation mode and integrated the feature of the real trainee.Similar to artificial coach, artificial trainee also included three state to map with the real learning process, which made to optimum. In description trainee, the features such as the position of the work, education, the skills proficiency had been described in artificial way.

4.1.3. Predict Trainee

According to various data and parameters, the system can provide different strategies for improving and apply them into uniform description trainee, that is, computational experiments, and obtain the possibility state that may occurred. And the predict trainee provided the different results according to different training method. And these results could be choose for ability development.

4.1.4. Guiding Trainee

Guiding trainee was the optimum strategies that arrived by computational experiments which focused on the ability development objects. With applying these strategies into description trainee and executing them in parallel, the guiding function had been realized.

4.1.5. Artificial Service People

In the real training process, besides the coach and trainee, there were service people involved in. So we should build them in the artificial scene. Similar to the above idea, artificial service people also included three states: description, prediction and the guide. The description service people integrated the former information of the experiences.

4.1.6. The Prediction Service People

The prediction service people analyzed the trainee information and compute the optimum mode of the service. The guiding service people applied the result of optimum experiments into the artificial and real system to realize the parallel execution.

4.1.7. Other involved people

Besides the roles mentioned above, the training center operation also needs other involved people. We should also build them in the artificial scene.

4.2. The Intelligent Training System Based on ACP

The coach and the ability development requirement consists of a set of training programs. In order to meet the requirement, we proposed to build the intelligent training system based on ACP. The process of strategies making between artificial coach and trainee based on ACP theory in artificial and real scene were shown on Figure 5.

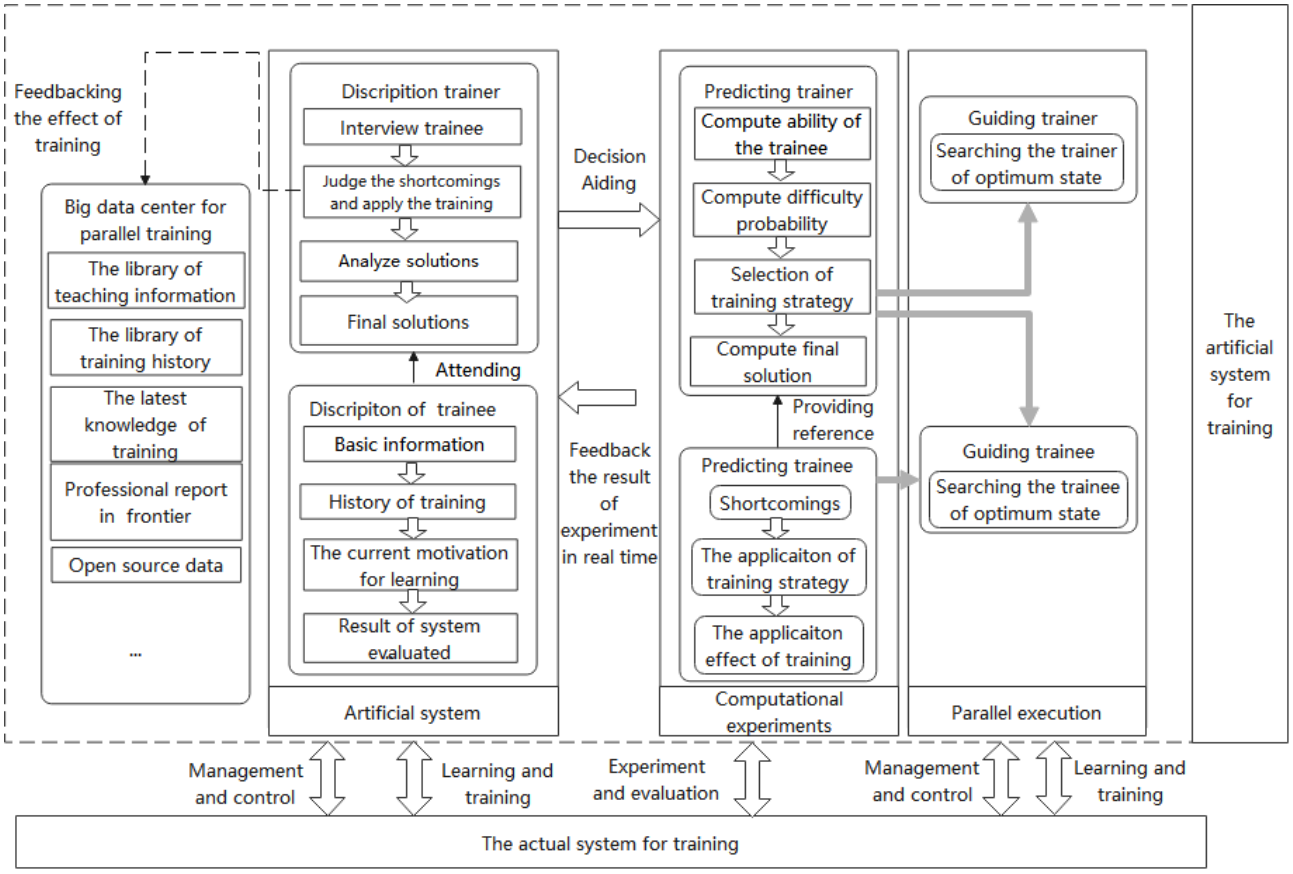

Figure 5 The intelligent training system based on ACP

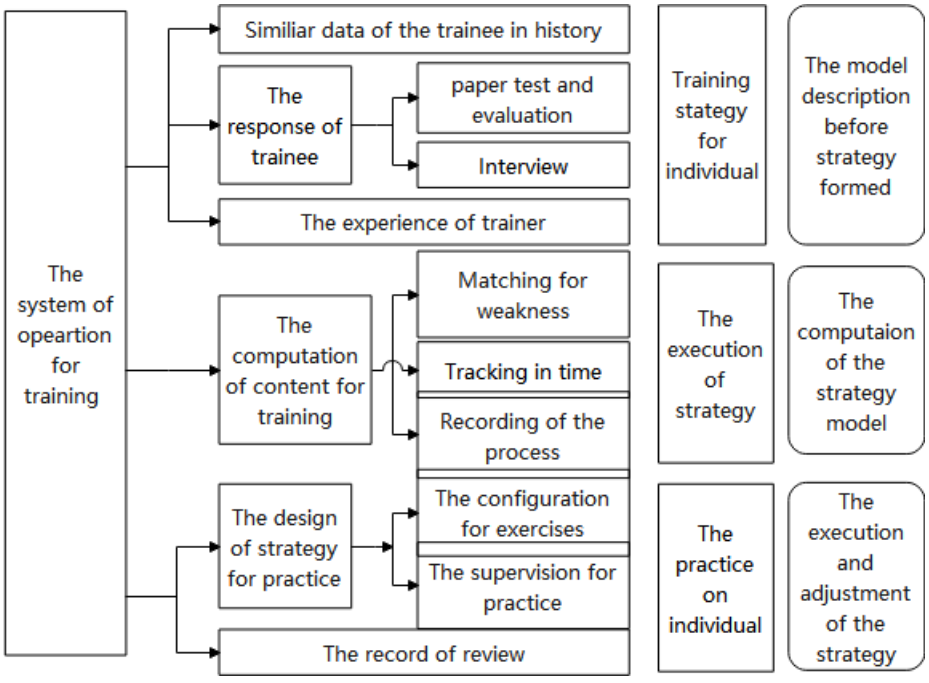

Figure 6 The design and execution of the parallel train strategies based on ACP

According to the current state of the trainee, the predict coach provided the training strategies by composing big data experience and the existing knowledge of the description coach. According to training strategies and description trainee, the system took the advantage of predict trainee to make evaluation and feedback the results to artificial and real coach. The real coach will adjust the recommend strategies via their own experience and feedback the changing to the system, and the system will update the state of the corresponding description coach and the trainee. Via interaction between artificial and real, the final training strategies would be arrived, which realized the idea that

artificial coach guided the real coach. It is necessary to implement the real-time tracking of the training process for the lifetime training of the trainee. By means of artificial system, computational experiments and parallel execution, we can obtain the recommend ability improving strategies for each trainee. Besides, we can track and adjust the strategies with intelligence assistant means to make it exert much more better. The design and execution of the parallel train strategies based on ACP theory was shown on Figure 6.

4.2.1. The Intelligent Training Energy Management System

In order to realize the goal of carbon emission peak and carbon neutrality, we should make the optimum use of the resources such as water, gas, heat, electricity and so on and reduce the emission. By means of ACP theory, we can build the intelligent training energy management system. With artificial system, computational experiment and parallel execution, the interaction of artificial and real system will guide us to realize our goal.

4.2.2. Other Intelligent Systems

With the ACP theory, we build the facilities models in the artificial system, and execute the parallel control theory. As the process data accumulated, we can realized some highly application such as optimum, statistics, and distribution of resources in dynamic and useful way. At the same time, we can realized the online long-term tracking of the training hardware, buildings, facilities and so on. And we can make the maintenance much more timely and easy to implement.

5. Conclusion

In this paper, we focused on efficient operation of the training center, with the parallel intelligence theory, constructed the new intelligent integration training operation system by description intelligence, prediction intelligence and guiding intelligence. The new system can realized the interaction between artificial and real system, which integrated all the physical equipment, involved people, as well as geo-physical information resources and build the models of them in the artificial scene. By means of the interaction between the artificial and real , we can realize he uniform and high efficiency of the operation.

As to the whole paper, first we introduce the theory of parallel system, and then make the feasible analysis of the intelligent integration training operation system and present its design idea, finally, we provide the implementation method of the system. The idea of parallel training provide an uniform and efficient application architecture for using the intelligent technology in education and training area, which was of the great significance to the development of enterprise training in the future.

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References

[1] Maganioti, A.E., Chrissanthi, H.D., Charalabos, P.C., Andreas, R.D., George, P.N. and Christos, C.N. (2010) Cointegration of Event-Related Potential (ERP) Signals in Experiments with Different Electromagnetic Field (EMF) Conditions. Health, 2, 400-406.

[2] Bootorabi, F., Haapasalo, J., Smith, E., Haapasalo, H. and Parkkila, S. (2011) Carbonic Anhydrase VII—A Potential Prognostic Marker in Gliomas. Health, 3, 6-12.

[3] XU Yusen, CHEN Yunqi, (2010) The Function System of the Corporate University and Its Evolutionary Process: The Longitudinal Case Study on Haier University and Huawei University,

SCIENCE OF SCIENCE AND MANAGEMENT OF S.&.T, 39, 95- 103.

[4] WANG Fei, WANG Qiu, SUN Jianlong, REN Jiayi, CHEN Junjie, YIN Chao, ZHANG Lei.(2018)Real Data-driven 3D Smart Simulation Technology for Substation, Smart Power, 48, 112- 117, Jul 2020.

[5] WANG Fei-yue,(2004) Parallel system methods for management and control of complex, Control and Decision, 19, 485- 489+514.

[6] WANG Yong-Jun, WANG Fei-Yue, WANG Ge, WANG Xiao, WANG Yi-Long, LI Rui.(2021) “Parallel Hospitals: From Hospital Information System (HIS) to Hospital Smart Operating System (HSOS), ACTA AUTOMATICA SINICA, 47, 2585-2599.

[7] ZHANG Jun, XU Pei-Dong, WANG Fei-Yue.(2020)Parallel Systems and Digital Twins: A Data-driven Mathematical Representation and Computational Framework, ACTA AUTOMATICA SINICA, 46, 1346- 1356.