Simulate a Training System for Train Dispatching Command in High-speed Railway

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ABSTRACT: The safety issues of high speed railway have always been widely concerned by people. With the rapid development of high speed railway technologies, China has not only achieved great success, but will also popularize a complete set of modern high speed railway technologies to the rest of the world. Systematic, mature and stable dispatching command system for high speed railway is the foundation to guarantee its safety operation. The research thereon can provide good training conditions to cultivate dispatching command personnel with good skills and high quality to better ensure the safety of high speed railway.

KEYWORDS: High-speed Train dispatching command; simulation; training system

INTRODUCTION

It is generally known that the dispatching system is a key system of HST (High-Speed Train) systems during the HSR (High-Speed Railway) construction and involves a wide discipline range. The construction and operation processes of HSR in China have continuously made progress in recent years, which makes it urgent to research on simulation system for train dispatching command in high-speed railway, so as to accumulate valuable experience for the train dispatching command practices and talent cultivation. Besides, from the point of higher vocational education, the innovation of practical teaching mode is helpful for the higher vocational colleges to cultivate innovative talents, whereas for the students majoring in railway traffic operation and management, train dispatching skill is rather essential to them. Through repeated trainings on simulation training system, the students can better improve their vocational skills and further become the talents with innovative knowledge.

1. OVERVIEW OF SIMULATION SYSTEM

The simulation refers to studying a system under design or an existing system through modeling the system. System simulation technology is a comprehensive discipline and is increasingly applicable with the social development. The simulation training system in HSR has complicate structure, lacking effective analysis and analytical method. In such case, the research on the system shall be dependent on the computer simulation technology.
2. OVERVIEW OF SIMULATION TRAINING SYSTEM FOR TRAIN DISPATCHING COMMAND IN HSR

Firstly, the function modules of such system are linked through the LAN which can organically connect those scattered modules together as a dynamic and complete system. The training teachers are responsible for organizing and maintaining the teaching of the system and managing and supervising all modules of the system. The network communication of the system is realized through the Ethernet with strong anti-interference ability. The training system has a quite complete simulation module for train dispatching command in HSR. With such module, the running status of trains at stations and in sections can be monitored in real time and adjusted dynamically, the stage plan of trains operating in three hours can be automatically generated, the train dispatching command automatically given and the actual running diagram drawn. In addition, the quantity of trains detaching and attaching at junction station, punctuality, traveling density, reasons for earlier and later arrival and key train tracking can be statistically analyzed in real time in macroscopic view and relevant statistical statements can be produced; moreover, basic technical data such as railway network, tracks/stations along the line and distribution of relief trains as well as meteorological data can be displayed to provide decision reference for railway accident rescue, disaster rescue and flood prevention.

Secondly, such system also includes teaching, drilling and evaluation modules. The teaching of the system can be realized by the multimedia with human-machine interface (HMI) which is commonly used for modern teaching. All the knowledge about operation organization and dispatching command is presented through multimedia. Drilling contents are pre-set by the teacher, including type of trains and type and location of fault and weather change. Then the students can correspondingly process and operate. Besides, the records of each simulated training system will be completely saved in the database of the system, convenient for the teachers to evaluate the actual performance of students and give scores.

![Figure 1. Computer Simulation.](image-url)
3. CONFIGURATION AND FUNCTION

The simulation system mainly includes control simulation system for dispatching command, interactive operating system for students and viewing and simulating system and workstation system for teachers. The control simulation system for dispatching command contains dispatching center subsystem which has simulation systems for train dispatching console, assistant dispatching console and comprehensive maintenance, photoelectric station yard and printing equipment. The control simulation system also includes station command subsystem which is mainly provided with self-regulated machine system, attendant system and signalman system in the station, photoelectric station yard and printing equipment. The control simulation system is mainly used for preparing primary diagram, daily shift plan, and shunting operation plan, drawing train number tracking and actual running diagram, monitoring train operation, transferring dispatching command and train speed message, generating running log of station, statistical statements and shunting work order, editing and delivering trailer plan, selecting and arranging shunting route and settling the disputes between the shunting operation and train operation. The shift plan is shown below:

![Shift Plan](image)

The operation control and display equipment on the interactive operating system for students remains the same with the train dispatching equipment, which is operable and has same functions and control logic with the actual dispatching equipment. The students can realize the simulation control of train dispatching command based on the equipment. The functions of one-time standardized operation, emergency response and abnormal running can be realized through the multimedia teaching of the system. The normal simulation dispatching, abnormal dispatching and emergency response drills can mainly be operated. And the abnormal dispatching drill and emergency response can be evaluated. Viewing and simulating system is composed of projector and ordinary single-channel projection screen. The system is set together with the interactive operating system for students and is performed through the control and switch operation of teachers. The teachers can teach in a centralized way and coach the students with their independent study through the system. Workstation system for teachers is composed of console, system server, computers and monitors. Thus, the teacher can maintain the system, evaluate and manage the performance and set tasks through the console.
In recent years, colleges of transportation management of the vocational colleges are being prepared to build or have built the training system for train dispatching command. Now most of the training systems of vocational colleges integrate computer interlocking softwares, underlying interlocking logic and status and change of site equipment into sand table through the software and hardware in joint simulation, thereby providing a comprehensive and intuitive simulation training environment for the students majoring in rail transportation. Meanwhile, the simulation training system, with some teaching and training characteristics, can monitor the equipment operation process of students through computer of teachers and improve the emergency treatment ability of students by setting equipment failures.

4. SIGNIFICANCE OF SIMULATION TRAINING SYSTEM FOR TRAIN DISPATCHING COMMAND IN HSR

Railway is one of the vital infrastructures for economic development of a country, and the train dispatching command system is the key to this vital infrastructure. For the students majoring in railway traffic operation and management in higher vocational colleges, they just understand the simply and theoretical information about dispatching activities. However, the simulation training system is able to effectively help students understand the basic operation procedures. In addition, the students will master the emergency measures for the unexpected incidents in the process of actual application. It is well known that high speed railway will be most probably interfered by the unexpected incidents during the actual dispatching. In the process of study, the students are capable of understanding the emergency measures for the unexpected incidents through the simulation training system, thus, the accurate and fast judgment capacity and emergency disposal ability of students will be cultivated. This skill can be improved gradually and comprehensively with the accumulation of knowledge. Then, the students can handle any emergency in practical work calmly and precisely, and provide effective service for dispatching command of high-speed railway.

The department of railway traffic operation and management in higher vocational colleges demands strong practicability in accordance with its teaching objectives, however, the students are unable to directly participate in the train dispatching command of high-speed railway in the common teaching courses, which is unbeneficial for students to cultivate their creative awareness and exercise the professional skills. The simulation training system for train dispatching command in high-speed railway focuses on effectively improving the practical capacity and vocational capacity of students. The teachings model of “practice after simulation, practical teaching after class teaching” supports the capacity cultivation of students.

In addition, the simulation training system involves various disciplines overlapping and blending with each other, reflecting its prominent feature of innovativeness. It is very important for the cultivation of students majored in railway transport, the improvement of railway transport informatization and so on.

It cannot be denied that, despite the worldwide research on and existing achievements of simulation training system of high-speed railway, the equipment of high-speed railway is relatively complex and involve many uncertainties, therefore the simulation training system for train dispatching command is quite demanding in environmental conditions.
and contains advanced technology. Until now there is rare specific study on simulation training system for train dispatching command in high-speed railway, leading to the insufficient scale and lack of experimental conditions for the simulation training system in China.

5. CONCLUSIONS

Now, with the rapid development of high-speed railway in China, the safety issues of high speed railway have become a social concern. Systematic, mature and stable dispatching command system for high speed railway is the foundation to guarantee its safety operation. The research on simulation training system for train dispatching command in high-speed railway can provide good training conditions to cultivate dispatching command personnel with good skills and high quality to better ensure the safety of high speed railway.

REFERENCES