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Research on Mechatronics Technology of Mechatronics Engineering Department via Apriori Algorithm

Elena Martínez [1*]

[1] Assistant Professor, Department of Software Engineering, University of Barcelona, Barcelona, Spain
* **Corresponding Author:** e.martinez@ub.edu

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ABSTRACT

The mechatronics virtual simulation experiment system uses three-dimensional virtual simulator, virtual reality (VR) for experiments, interactive functional simulation equipment, automation and other simulation experiments to simulate the teaching system. Teaching practice shows that the system has autonomy, learning, interaction and immersion. It can improve the understanding of the structure, principle and process of electromechanical engineering, stimulate students' interest and initiative, and improve students' innovation ability.

Keywords: Mechatronics, Three-dimensional Virtual Simulator, Apriori Algorithm, Mechatronics Engineering.

CURRENT SITUATION AND ANALYSIS OF MINING ENGINEERING EXPERIMENTAL TEACHING

In modern teaching, experimental training is an important part of theoretical connection. Focusing on and strengthening (H. Wang, Zheng, Wang, Chen, & Yuan, 2018) experimental teaching research is needed to improve students' subjective initiative, requiring on-site training and conduct. Students are unable to enter modern mines for field study and experiments, which hinders the learning of equipment such as electromechanical machines and hydraulic shocks. At the same time, most of the virtual display system in China at the present stage is the audio-visual information display of industrial production system, a non-grasping virtual display system, which cannot meet the students' non-interactive operation and non-immersive mine virtual display simulation system. With the rapid development of virtual simulation technology, many universities at home and abroad have made remarkable achievements in the teaching of the electromechanical engineering virtual simulation experiment system as the key element, but the electromechanical machinery VR technology training is rare in China.

(1) The experimental methods are backward, the student participation is low, and the teaching effect is poor. It is not easy for apprentices to participate in pilot projects. (2) Mechanical and electrical safety situation is poor, practical teaching is difficult to implement. Although mining engineering organizes cognitive practice, production training and graduation study in the teaching process, many school districts are not ready for internship due to the severe electromechanical safety situation and difficult internship arrangements. In addition, underground training can only see some conditions. When students fall, they tend to bow for innovation or fear, mainly visiting models and demonstrations. National policies (Huang, Zhang, Xu, Wu, & Chambers, 2017) and national policies run counter to national policies, students rely on teachers to explain information, teaching methods are passive, students cannot participate.

Virtual Reality technology in Carbon Safety Management

The combination of Virtual Reality (VR) (Kühne et al., 2018; Liu, Jiang, Donovan, Wen, & Sun, 2015) and virtual manufacturing carbon is to study that when an accident occurs, emergency workers need to understand the exact situation of the accident site and the possible evolution of the accident, and sometimes even need remote control (such as the main experts on the site). Accident handling does not arrive at the accident site and is done by combining VR technology with other simulation techniques and various monitoring and control systems in the mine. In addition, VR technology can also be used to simulate uncontrollable accidents and conduct emergency training for high-risk accidents. The company develops it to improve employees' disaster relief and self-rescue ability, and conducts daily disaster prevention and safety education and training. The mining production environment created by VR technology is characterized by lively and good interactive effect. It can simulate the mining environment and its operating process in a similar manner, providing three-level education and special training for company employees. This can reduce the internship cost, and can shorten the teaching time, but also can provide underground staff training and safety education, build VR technology system, for specific accident, specific area for accident simulation and training, enable people to accept accident prevention training and accident rescue personnel operation training, so as to improve people's accident awareness and technical operation level, escort the success of rescue workers. For example, the various work and dangerous conditions of virtual mines, let them experience the VR technology system, learn to take effective emergency measures to deal with the various dangerous conditions, improve the quality of employees, and eliminate potential accidents. The virtual design and manufacturing of mining equipment, due to the narrow underground site and harsh environment, put high requirements for the design, operation and maintenance of street equipment. The virtual design (Boivin, Aouffen, Fournier, & Mateescu, 2001) and production of mining equipment means not only saving money and time, but also doing work that cannot be done on the ground or under normal conditions.

Overall Implementation Process of Virtual Simulation Experiment Teaching of Electromechanical Engineering

The virtual simulation experiment system of electromechanical engineering is based on the large mining and high working face. According to the storage requirements and production capacity requirements, the cutting model adopts MU900/2245-UWD. Its 3 D model is shown in **Figure 1**.

Figure 1. 3D Model of Mechanical and Electrical Engineering

Electromechanical engineering (Pickl, 2019) experimental system of mining face based on virtual simulation technology, combined with the current virtual simulation experiment operation and course teaching requirements, the complete implementation process of virtual simulation experiment of mining electromechanical engineering is shown in **Figure 2**.

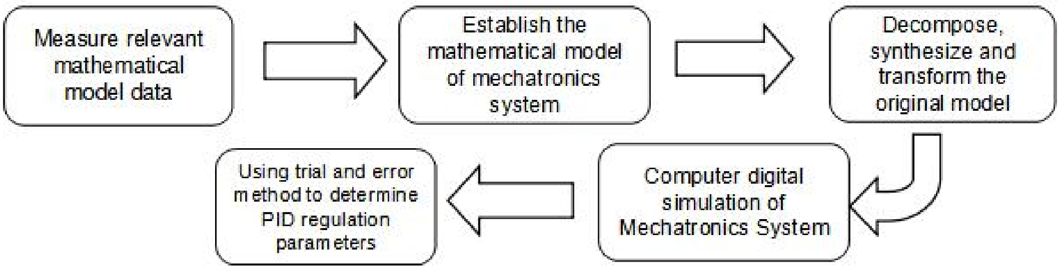

Figure 2. Implementation Process of Electromechanical Engineering Virtual Simulation Experiment

VIRTUAL SIMULATION EXPERIMENT TEACHING SYSTEM OF ELECTROMECHANICAL MINING

System Module Design

According to the master simulation program and experimental teaching related to mechanical and electrical mining, the virtual simulation experimental teaching system of mechanical and electrical mining is divided into different of professional supporting courses, such as, School of Safety Engineering, School of Geological Engineering and School of Mechanical Engineering (**Figure 1**). The study engineering credits include mining school community, Introduction to mining Township, Mine Pressure and Its Control, Well Lane Engineering, Mining Damage and Protection and other professional backbone courses, including more than 50 teaching and experiment materials for my development, more mining technology, tunnel technology, blasting technology, and mine pressure. Safety units mainly offer courses of Mine Ventilation, Mine Ventilation and Air Regulation, and Mine Disaster and Prevention, including nearly 30 experimental materials for mine ventilation, disaster and quarry prevention, gas drainage and exploration and water release, and the influence of geological structure on mining production; Mechanical engineering unit is an experimental teaching system developed for courses, such as Mining machinery and Mining electrical Engineering. The purpose is to let students understand the mining process, working methods, equipment and instruments, etc. In addition, the simulation of mining system, mine identification and other virtual simulator experiments, has a three-dimensional, fascinating virtual simulator system, let you enter the virtual scene through man-machine communication. Through animation and explanation, students can understand the operation environment of the mine through independent learning, as an important supplement to practice education.

Implementation Method of the Experimental Project

Two methods (Bojaj, Agahi, & Hoxha, 2021) for experimental teaching projects: network sharing and virtual and real combination (**Figure 3** and **Figure 4**). In some complex visual textbooks of technical processes, disasters, local connections and extensive equipment structure, a number of three-dimensional animation and human-computer interaction imitations have been produced and developed, and deployed on campus to achieve networking. Students can conduct experiments independently through video and on-demand networks and simulation programs. Some pilot projects, such as mental simulation systems, employ game cleaning techniques to inform students about the composition of the mining system and the underground working environment for recreation. In some experimental projects, you will follow the principle of combining virtual and real, complementing each other, rather than virtual, and develop virtual simulation of the combined experimental platform, such as virtual simulation of fully mechanized mining technology and virtual simulation of fully mechanized mining technology. The experimental teaching projects all adopt the combination of virtual and real conditions, and adopt the distributed virtual simulation technology to realize the connection and integration of multiple virtual simulator devices. Mining techniques include mechanical and electrical engineering, hydraulic supports, crawler excavators, and shovels. Conveyors (Neigel, Claypoole, Waldfogle, Acharya, & Hancock, 2020) and other virtual simulation devices that can be controlled individually or jointly by implementing the simulation kiosks throughout a fully engineered mining process. By comparing the quality evaluation indexes of the two methods, this aspect is divided into five levels: '50', '100', '150', '200' and '250', as shown in **Figure 5**.

Figure 3. Network Sharing Virtual Experiment Project

Figure 4. Virtual and Real Combination of Simulation Experiment Project

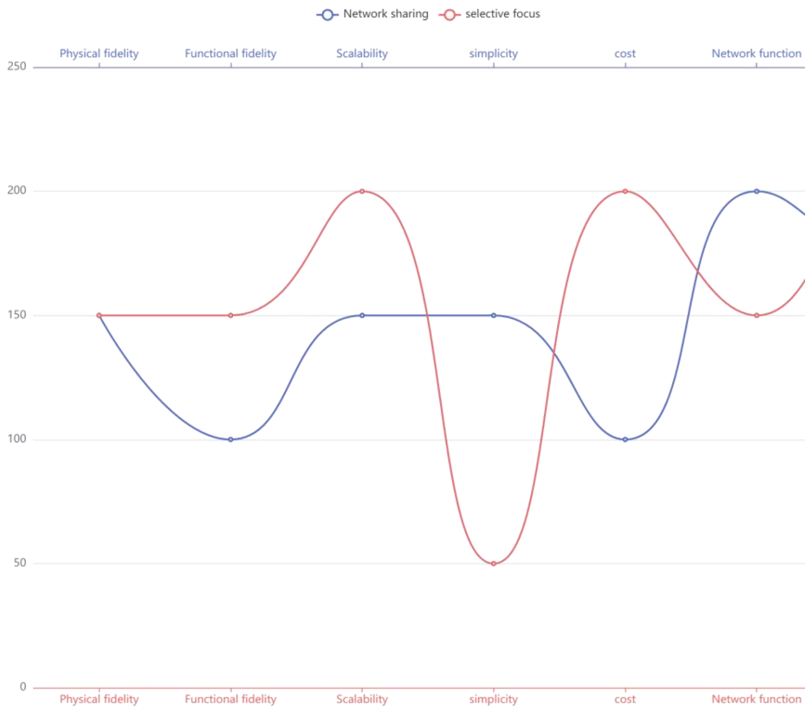

Figure 5. Comparison of Various Quality Evaluation Indexes

EXPERIMENTAL TEACHING OF ELECTROMECHANICAL ENGINEERING STRUCTURE

Combined with 3D simulator (Legette, 1993) and VR technology, MU900/2245-UWD mechanical and electrical engineering visual setting, cutting part of the structure, conveying system and grasp part of the structure and electronic control equipment, interactive operation, understand and master the structure and composition of mechanical and electrical engineering.

(1) Interactive operation of the virtual simulator system (Harris, Gee, d′Acquisto, Ogan, & Pritchett, 2015). The powerful structure of the cutting parts and transportation system of MU900/2245-UWD electromechanical engineering is shown for practical display, and the interactive action interface is shown in **Figure 6**.

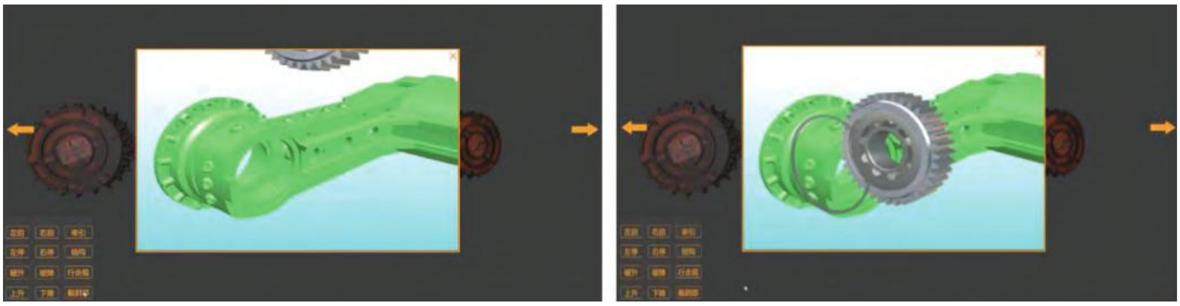

Figure 6. Dynamic Display of Interactive Operation Interface of Mechanical and Electrical Engineering Cutting Section

(2) Interactive operation of the virtual simulator experimental system to effectively demonstrate the MU900/2245-UWD cutting equipment, grid wheels and couplings and other mechanical components.

Operation of Mechanical and Electrical Engineering Experiment Teaching

First of all, according to the operation rules of mechanical and electrical engineering, the positive and negative grasping action of mechanical and electrical engineering is carried out on the control panel of the drum purifier in the form of human-machine interaction. As shown in **Figure 7**, the mouse clicks on the left pull and right pull on the lower left corner of the chopping board, where the tool will move along the pin row on the scraper conveyor chute. Move between left and right (Harris et al., 2015).

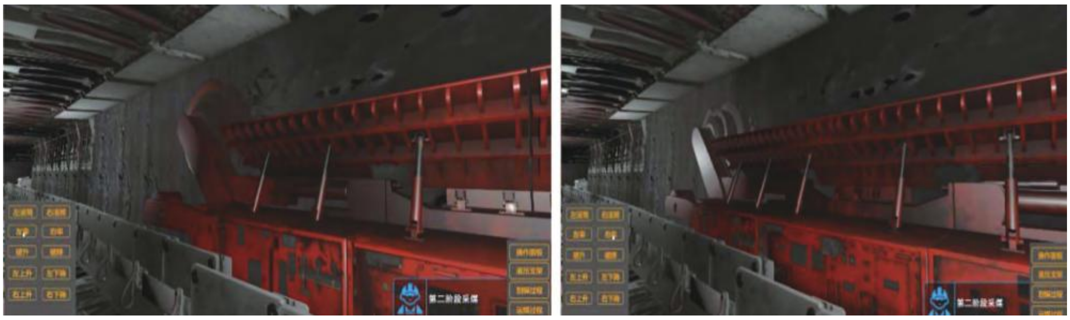

Figure 7. Electromechanical Engineering (left) and Traction Interactive Operation Interface (right)

Then, through the traction speed, drum cutting speed, drum speed and other interactive variables, according to different working conditions, adjust the traction speed of mechanical and electrical engineering practice, adjust the cutting drum height and speed and other functions and control the performance of the tool operation. The specific operation are as follows. (1) In the interface of adjusting the grasping speed parameters, you can click the left rise and left down in the lower left corner of the control system to input the speed size, and the mechanical and electrical engineering can adjust the variable value accordingly to move to the left and right. (2) In the interactive tool interface to adjust the height of the drum, you can click right up and right down on the clipboard in the lower left corner with the mouse, and the electromechanical engineering interactive control to adjust the drum speed (Henning & Bobholz, 2016). The interface of is shown in **Figure 8**.

Figure 8. Interactive Operation Interface for Adjusting Rotation Speed of Left Roller in Mechanical and Electrical Engineering

Mechatronics Process and Process Organization and Circular Experimental Teaching

With the mining process as the core, at the end of the working face, a series of mining, moving rack, push conveyor belt organized a regular cycle, inclined mining operation. The purpose is to simulate the oblique cutting process of mining process, mining method and mining process, so that students can master the corresponding relationship between mechanical and electrical engineering, hydraulic support and scraper.

Control the cutting equipment and hydraulic support plate of the virtual simulator experimental system, and simulate the experiment of civil wall electromechanical according to the design requirements after the inclined cutting process (Henning & Bobholz, 2016; Y. Wang et al., 2008). Interactive operation interface of multi-person collaborative electromechanical engineering, feed knife interactive operation as shown in **Figure 9**.

Figure 9. Interactive Operation Interface of Multi-person Cooperative Mechanical and Electrical Engineering End Oblique Cutting Tool

Students are responsible for controlling the mining of the left drum when the mechanical and electrical engineering drops the top cut, turning the drum to the highest point to cut the top, and turning the right drum to the lowest point to cut the bottom. Students are moving away from the left drum. Use a hydraulic aid plate to move the scraper conveyor in segments down to about 35m. When electromechanical engineering cuts the conveyor, the students who control electromechanical engineering gradually reduce the left drum to cut the bottom, and the students who control the fluid support move the conveyor belt into a snake. When the electromechanical engineering control students lifted the right drum to the top to start the cutting, the diagonal cut was about 73 m, and the students controlling the hydraulic support moved the conveyor belt in a straight line.

1. When the electromechanical engineering student drops the right drum, lift the left drum to start down until the transport road, turn the roller position up and down, and then quickly over the electromechanical engineering position. Slkew and start usually up, then apply hydraulic pressure. The student of the stent moves the lower conveyor belt until the airway returns.

2. According to the mechatronics process, the landing method and sliding method are sensitive mining face, control the drum cutting and simulate the normal cutting test. In the interactive operation interface between standard knife and multi-knife, the imitation system controls in multi-knife mode. First, the system is cut into the mining process to control the mining process. The machine students adjust the height and traction speed of the drum according to the need, carry out standard cutting operations, and adjust the traction speed and drum height of the drum during the process.

3. By monitoring the mechanical and electrical situation, multi-person cooperative operation, control the control panel of the 0-hydraulic control system, pull back the two-level protection board, mechanical and electrical engineering.

4. Multiple people shall jointly control the hydraulic support control panel. Multiple hydraulic supports can be moved continuously according to the mining conditions of the working face. The scaffold distance (Hemeida et al., 2020) and the same cutting depth were 800 mm.

5. Work together with many people. The hydraulic support control panel performs the continuous lifting operation of multiple hydraulic supports with a lifting height of about 100mm and two levels of fenders sticking out to protect the charcoal wall.

6. The controller panel of the hydraulic support. The moving distance is 0.8m, and the bending part shall be less than 35 m. The maximum horizontal bending of the chute is 10, and the vertical bending shall not exceed 30 degrees.

Experimental Teaching of Following Machine Automation

According to the mining operation (Song et al., 2018), you are faced with automatic mining instructions. According to the (rock) hardness and parameters of the cutting equipment, set the grasping speed and cutting speed of the cutting equipment, and operate a real simulation system to realize random automatic cutting. There are two triangular regions at the end of the triangle cut, which are basically the same. In the first stage, the electromechanical works move from the center of the work table to the nose, and then move the rack until the electromechanical works reach the nose. In the second stage, the electromechanical work began to walk toward the trunk of the machine, until the bracket was not. The rear drum leaves the support, and the machine's automatic push with the machine in order. Slide and follow the machine to automatically move the shelves until all the shelves are in place. In the third stage, the electromechanical works moves to the engine head in the absence to start the automatic movement of the bracket accompanying the machine to the next stage. This stage is completed when the barber cutter reaches the nose. In stage 4, the electromechanical work began to move toward the machine trunk.

APPLICATION OF VIRTUAL SIMULATION EXPERIMENT TECHNOLOGY

The mechatronics process of virtual simulation experiment creates an autonomous learnin environment for students. By interacting with the information environment rather than the conventional education method, students acquire a new learning method, which makes up for the lack of electromechanical training. Take the virtual experimental (K. F. Wang & Wang, 2017) teaching equipment of integrated mechanical mining technology as an example to briefly introduce the teaching method of virtual simulation experimental mining.

Virtual Simulation Teaching Instrument of fully Mechanized Mining Process

Mechanical and electrical mechanical (Yan, 2017) mining technology teaching tools training simulation experimental structure includes: mechanical and electrical engineering operator control panel and operation buttons, staff control panel (3 sets), joystick and operation buttons and auxiliary tools, 2 screen hydraulic support display, accessory display, circuit board, single chip computer and other accessories. The mechanical and electrical engineering driver engine with the virtual simulation experimental teaching device of integrated mechanical mining technology can control the starting, lifting and cutting off of the left and right rollers and the carbon starting mining engine through two mechanical and electrical engineering drivers A and B. Walking and other basic operations can also display different feeding methods and collaborative cutting methods; 3 support personnel can be managed by 3 logistics personnel C, D, E to complete the cutting screen, the rear guard down, and timely support to push the scraper conveyor belt; instead of auxiliary equipment, the pump can be controlled instead of the assistance of workers. With the cooperation of 6 people, almost all kinds of processes in the mechanical and electrical equipment are all completed in a certain order, such as feeding, cutting, supporting continuous movement, scraping movement, etc., and can display full screen synchronization on the projector.

Experimental Project

Fully mechanized mining process mainly includes the cutting and installation of cutting machine, carbon conveyor transportation and transport, hydraulic support support support, floor treatment, etc. Experimental teaching tools realize the integration of many simulators. During the experiment, the students learned about the collaborative nature of many people imitating hairdressers, support staff, scraper engineers, and other types of rescue workers. Carbon cutting (Z. L. Wang, Jiang, & Xu, 2017) method of working face, work of motion frame and scraper, rock research treatment in goaf, etc.

EXPERIMENTAL TEACHING EFFECT

Revolution in teaching philosophy. This reduces the investment in energy-intensive experimental equipment, saves costs, and the textbook abstract knowledge is real and intuitive, and increases the students' professional interest and practical ability.

The textbooks are closely related to the reality. The virtual simulation experiment system of mechanical and electrical engineering can complete the structure, installation, supporting equipment and transformation of mechanical and electrical engineering supporting equipment and hydraulic support equipment in the production process, especially suitable for students who cannot enter the actual production and production. Adopt technology, let the students have a sense of immersive.

The system is stable and open. The editor's virtual simulator experimental system can not only operate stably and reliably on standalone machines. Editor The virtual simulator experiment system can record the whole process of students' participation in the experiment, and can be guided at any time. There is a perfect assessment standard for students' preview effect, experimental action and experimental results, which improves the fairness of the assessment. It provides a tutorial guide for optimizing and refining the experiments. Many tools and equipment are prone to damage and difficult to maintain due to long-term stress. Virtual laboratories can be reused on a large scale over a long time, and the physical consumption cost is almost negligible. There is no storage or material insufficiency, incomplete materials and other problems, long service life, long service life.

Convenient the update and expansion of pilot projects. As the conventional teaching resource of hardware and practical teaching equipment, some valuable tools and equipment may be endangered in a short time due to the accelerated technology advances; buying new equipment may face the same risk. With the improvement of virtual simulation technology, fast upgrade speed and low risk, we can timely add necessary information according to the experiment outline and content. In short, compared with the conventional practical teaching methods, using virtual simulation technology for practical teaching has obvious advantages.

The experimental system of the editor virtual simulator is based on large workfaces in mining. With the complete realization process of mechanical and electrical engineering simulation experiment, complete the structure of mechanical engineering, the operation of mechanical engineering, the organization of mining cycle, and the automatic cutting of machine. The experimental decompression system uses 3D and VR techniques, which violate time and space limitations, allowing students to clearly demonstrate the internal structure, working attitude and characteristics of electronic devices, such as scissors, making them feel small. Students cannot control the actual equipment in the workplace. At the same time, students 'interest and initiative in the experiment can let students design experiments and sports at the same time, master the basic knowledge, solve practical problems, and strengthen students' innovation ability.

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