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The Design and Construction of Decision-making Command System for Digital Oilfield Emergency Drill

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Abstract

With the theme of global economic development. China's oil companies are moving forward in the digitization process, the ability to prevent and handle emergencies are in more urgent needs, when the Oilfields encounter risks of various major unexpected security incidents, an isolated burst event is likely to have spillover effects, then evolved into great social disasters, and posed a serious threat to production security, social stability and people's lives. This article contrary to the view of the above situation, combined with Virtual Reality technology and Workflow technology to build a Digital Oilfield Emergency decision-making command system, looking forward to play the aider and endorsement role with Oilfield Emergency command decision-making.

1. Introduction

With the theme of global economic development, preventing and handling the major emergencies' public safety system facilities' construction, such as emergency relief, security defense etc, has become the main tasks to different countries and regions of the world. China's oil companies are moving forward in the digitization process, the ability to prevent and handle emergencies are in more urgent needs, when the Oilfields encounter various major unexpected risks of security incidents, an isolated burst event is likely to have spillover effects, then evolved into great social disasters, and posed a serious threat to production security, social stability and people's lives. In this respect, the needs of Digital Oilfield Emergency decision-making command system came into being.

Unexpected security incidents are the crisis of non-equilibrium state, leading the society deviate from the normal track. Most unexpected events occurred under the circumstances of no obvious indications, once occurred, they can spread quickly, even out of control, and may result in serious physical and mental harm. Therefore, prevention and drill in advance is especially important for the Oilfield Emergency decision-making command. For the above situation, the author proposed an emergency simulation drill

system model, by means of virtual reality and collaborative work to achieve decision-making command of emergency drill, enhancing the response capacity of emergency system, at the same time increase the collaborative combat capability of the enterprise, and solve the high cost problems in real drills. Evaluating the science and feasibility effectively of security plans.

2. Basic Concept

ISO Workflow Technology Workflow Management Coalition[2] was established in 1993, its establishment marked the workflow technology began to enter the relatively mature stage, and played an increasingly important role.in the realm of applied research of computer. In global circumscription, the research of Workflow Technology and the development of related products entered a more prosperous stage, more and newer technologies are integrated in, documents management systems, databases, e-mail, mobile computiers, Internet services, etc. had already been accommodated to the workflow management system. Workflow products developed rapidly on the market. Moreover, with the development of computer technology, new technologies are brought into the workflow promptly by the workflow products' vendors to improve products' performance, making the workflow technology is constantly improving[5].

Workflow management system can be used to define and execute different coverage (individual workers, departments, enterprise-wide, inter-enterprise), different time span (minutes, hours, days, months) of the prosecution process. It all depends on the needs of realistic application background. In accordance with the different complexity of prosecution process and component activities, workflow management system can take many types of implementation modalities, in different ways of implementation modalities, there will be very different in the application of information technology, communication technology and support system structures. The actual operating environment of workflow management system can be in a working group within or across enterprise business units.
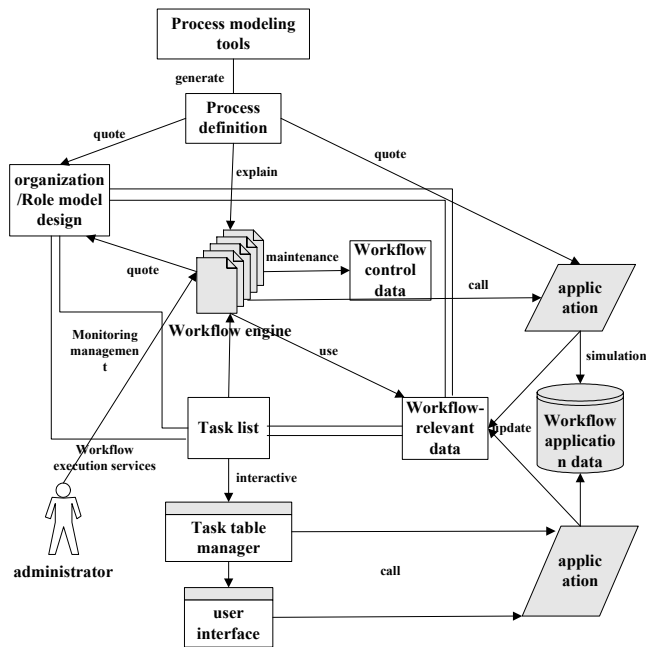

Figure 1 Schematic Workflow Principle[1]

Virtual reality technique (for short VR) is the senior Human-Computer Interaction technology by use of the high-tech, such as artificial intelligence, computer graphics, human-machine interface technology, multimedia technology, network technology, electronic technology, mechanical technology, audio-visual technology etc. to simulate peoples' vision, hearing, moving acts in the specific environment. Interactivity refers to the "participants" utilize visual, hearing, touch, smell and taste and other sensory functions, and dialogue, head movement, eye movement, turn around, pick and place and so the natural skills of humans to do interactive investigation and operation with virtual entities[2]. Some scholars explored the definition of virtual reality, considered that in addition to the interaction property, virtual reality was also provided with simulation and imagination properties[3].

The basic structure and the three most prominent features of Virtual Reality system are immersion, interaction and imagination, is so-called "triangle"(Immersion ⁻ Interaction ⁻ Imagination), which are the three basic properties of virtual reality system, as shown in Figure 2.
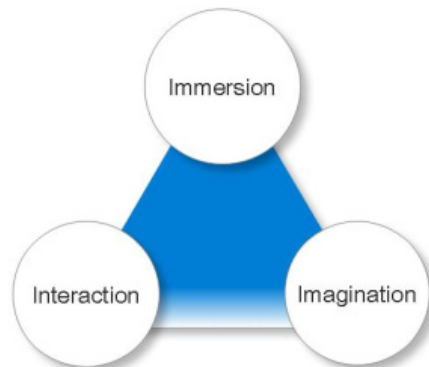

Figure 2 the basic characteristics of virtual reality system[4]

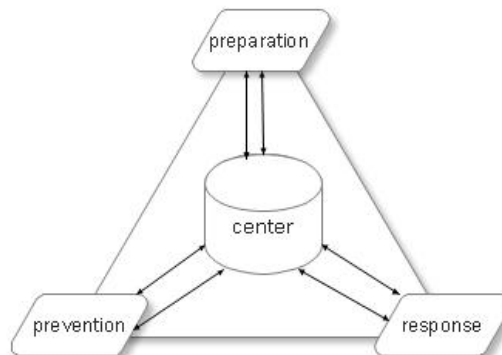### 3.   Overall Architecture of the System

Figure 3 the working mechanism of system

In the state of emergency, the relevant management departments will make rapid and accurate decision-makings, which based on the latest status and the feedback information. Because of the command of emergency decision-making involved multiple departments to work together, yet the oil companies and departments built different uses of databases respectively in the digital process, database's capacity

continued to expand, but had little progress in terms of sharing and communication, therefore, the data can not be utilized flexibly and effectively has become the enormous challenges of Oilfield Emergency decision-making command.

In systematic model of emergency simulation drills, we can achieve decision-making command of emergency drill by way of virtual reality and collaborative work to enhance the response capacity of emergency system, at the same time increase the collaborative combat capability of the enterprise, and solve the high cost problems in real drills. To make the related departments of emergency decision-making command response to emergencies more quickly, the coordination between the relevant staff more fully and making more effective decisions. It is particularly important for the Digital Oilfields' emergency work to establish a decision-making command of emergency working mechanism, which can prevent and drill beforehand, and set up a platform for decision-making command of emergency drill. The decision-making command platform of Digital Oilfield emergency drill based on workflow technology, virtual reality construction technique, constructed as follows:

The main information involved in decision-making command system of emergency drill are basic data, hazard data, critical infrastructure management data, monitoring and control data and plan management data, providing emergency resource management, emergency plan management, emergency management capability assessment, emergency drills information management, forecast and early warning information management in decision-making of drill.

Emergency exercise command and decision system database makes emergency drilling command center as work core, at all levels of the control center for the nodes distributed heterogeneous databases, analysis the data from each operational level to determine the organized way of business data, due to the complexity of the data structure, there is the need for a whole compatible architecture of data structure and distributed database and a complete data storage and backup scheme.
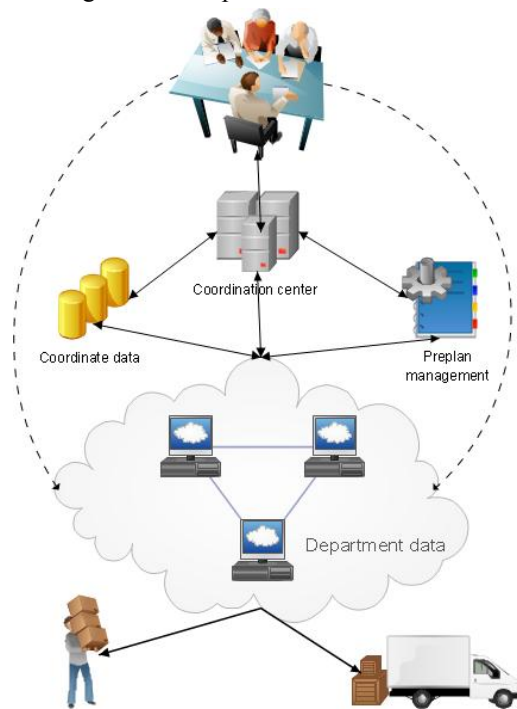

Figure 4 the working diagram for decision-making command platform of the Digital Oilfield emergency drill

4. the Advantages and Characteristics of Emergency Drill Command and Decision-making System

Emergency drill command and decision-making system is mainly for the leaders of Petroleum enterprise internal related management departments. It achieve the process simulation and tracking of emergencies, from the collection and repeatability of relevant data, the reporting and storage of emergency, real-time communication, and linkage command , simulates emergency on-site support, supported with leadership decision-making. This emergency exercise command and decision system can make the related departments have a beforehand and comprehensive grasp of emergency incidents before it occurs, at the same time, when emergency really happens ,there would be a more rapid response, more fully coordination of relevant staff and departments, and more effective decision-making. This can greatly reduce the work difficulty of the staff. This system has the following characteristics:

• integration: With incident dealing process as the core, It makes the related functions for effective integration. By integrating relational databases and non-relational databases, treat process and assist decision-making process ,to achieve function display and Information interaction expression.

• science: Through the aided decision-making database and emergency model library, make the leadership decision-making formed and sufficiently demonstrated before the incident, and make the actual command and decision to be more professional and comprehensive.

• Security: In emergency decision-making command, there are tight organization structure and personnel division, including data access permissions, to ensure that when the incident actually occurred this system can safely handle the entire process of rights management.

• Comprehensive: This system providing the function close to the needs of the user, including a variety means of communication, doesn't only reliefs work strength of major departments in the state of emergency, but also reduces the risk of leading decision-making; handles different data at the same time, also solves the contradiction of different incident dealing in a different way.

5. Summary

For preventive measures, drilling in advance of emergency strategy, Here proposed emergency simulation drill system model, by means of virtual reality and collaborative work to achieve decision-making command of emergency drill, Improve emergency system response ability and at the same time increase the combat capability of the enterprise collaboration, and solve the high cost problem of practical practices., evaluat the science and feasibility of security plan effectively.

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