Vault Laboratory Design

for Navigation Simulator

Wu Jianhua, Jin Jianguo, Zhou Kui, Zhao Xin

School of Transportation

Tianjin University of Technology

P. R. China, 300191

Abstract   The paper introduces the vault laboratory designed for shipping navigator simulator. The vault laboratory, based on multimedia technology and computer network system technology, is composed by two parts; navigator simulator and planetarium simulator, that connected between each other by network. The shipping navigator simulator will show corresponding seascape or port that the operator required, at the same time, the planetarium simulator will also show the astronomical phenomena of the period of the day according to the parameters that the operator entered. In the laboratory, student could not only study both the navigation technology by shipping simulator and astronomical phenomena knowledge by planetarium simulator, but also syncretize navigation technology with astronomical phenomena knowledge much better. Students could master much more competence abilities, such as chronometer orientation, navigate equipment calibration and adjustment etc. By using this laboratory, students will study more technology and improve their practice abilities as if they were onboard ships at sea.

Keywords   vault laboratory; simulator; design

0 Introduction

The vault laboratory, based on multimedia technology and computer network system technology, is composed by navigator simulator and planetarium simulator. By this means our training and education effects could reach the ideal results.

So far, navigator simulators and planetarium simulators are manufactured by many companies. These are ripe technologies. Many universities in our country have built navigator simulator and planetarium simulator laboratories. But these two laboratories are generally built up in two laboratory buildings or rooms. Although these laboratories have played a very important role in our navigation high education, we find that many integration studies and experiments could not be completed in the laboratories. For example, navigation equipments adjust according to astronomical phenomena and ship orientation and so on. In order to solve these questions, the vault laboratory has been designed for shipping navigation simulator specially. The vault laboratory, based on multimedia technology and computer network system technology, is

composed by navigator simulator and planetarium simulator. By using this laboratory, students could study more technology and improve their practice abilities as if they were onboard ships at sea.

1 Simulators and requirement

The inner of vault laboratory is built by two parts. One is a cylinder, which high is 4 meter and diameter is 18 meter. On the cylinder, it is a half ball, which radius is 9 meter.

We are going to choose a single ball planetarium simulator, which made by a Chinese company. This simulator could show 88 constellations, about 5100 stars, Canicula, nebulas and the Milky Way, both in the south and north sky. The planetarium simulator has four different coordinates system. One is equator coordinate system, the second one is ecliptic coordinate system, the third one is horizon coordinate, and the last one is meridian coordinate.

Single ball planetarium simulator is showed in Fig 1.

The movement of simulator could be controlled not only by the calendar, sky-high height and horizon but also by the center computer that connects with the navigator simulator.

The navigation simulator is a panorama simulator, which could display a wide visual field reaches to 270 degree that will show the students with different tides, wave or weather such as fine, cloudy, raining or snow in different time.
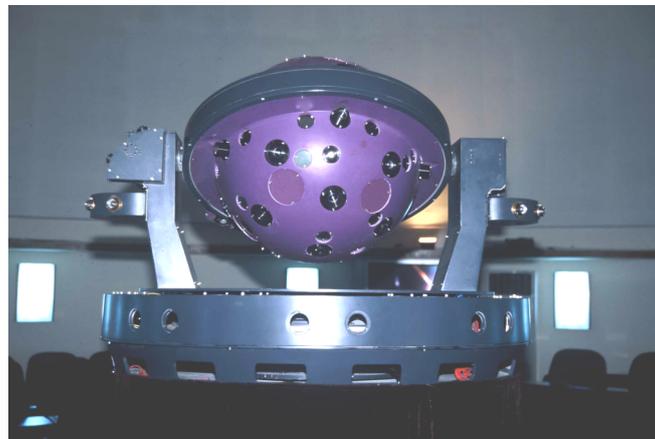
Fig. 1 Single ball planetarium simulato

2 Coordinate and movements

In order to make navigator simulator and single ball planetarium simulator synchronization, we have to do some special designs for driving system of the single ball planetarium simulator. First, we have to set up the coordinate that shows as Fig 2. Then we define some special movements and angles as follows.

2.1 Course angle driving system (ϕ)

Navigator simulator could show course angle very easily, when the operator turns around the

steering wheel. The vision, which is shown on the circle screen, will give your sense organ some information that the ship is swerving. But the single ball planetarium simulator, solar simulator and moon simulator could not do this so easily, since these simulators only could show that the sun or the moon rises from east. Traditional planetarium simulator could turn only in one direction that is clockwise to show the sun rise and sun down. We have to design a driving system, a servo motor system, on the single ball planetarium simulator to complete horizon movement, which is synchronization with the navigator simulator. By this mean, the operator could feel the ship is swerving through both seascape on the circle screen and astronomical phenomena on the vault.

Fig 2.   The coordinate of the ship

2.2   Pose swing angles (β, γ)

Pose angles could be divided into pitching angle β and rolling angle γ. Pitching angle β is a shake angle that wiggles from the fore to the poop system. Rolling angle γ is a shake angle that wiggles from the starboard to larboard. We have design two servo motors on the chassis of the single ball planetarium simulator to complete sky-high movement, which changes the movement of the Polaris altitude angle. The movement of the Polaris is synchronization with the navigator simulator. But the traditional planetarium simulator could not implement this movement.

2.3   Network and functions

In order to implement these two different kinds of equipment synchronization motions, we have to do some special design and reform. First we have designed a computer network system which is a center computer connected with these equipments, shown as fig3.

Fig 3.   The structure of simulators
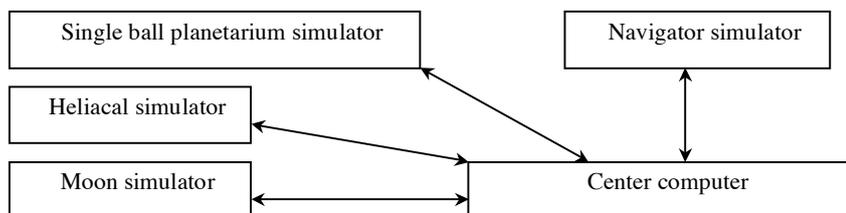
When the students utilize the simulator, we will input not only some parameters such as the kind of ship you have choses, the weather condition (wind power, wind direction, clear or cloudy, and so on), stream, parameters of the ship (sea gauge, speed and power of main engine, draft and so on), position (Longitude, latitude and course) as generally, but also time and date into the center computer. This computer will calculate your ship course angle and pose angle according to the parameters of weather, waves and steering wheel. And the computer will control single ball planetarium simulator synchronization with the navigator simulator. Navigator simulator will show corresponding seascape or port in accordance with the position the vessel situated, at the same time, the planetarium simulator will show the astronomical phenomena of the period of the day entered by the operator.

3 Effect drawing

We have designed a new laboratory building in our campus, which is shown in Fig 4.

Fig. 4   New laboratory building

Day and night scene of the vault laboratory inside is shown in the Fig 5 and Fig 6.
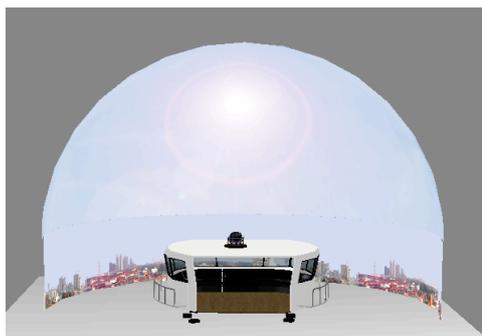
Fig. 5 Day scene of the vault

laboratory inside

Fig. 6 Night scene of the vault

laboratory inside

4 Result

In the vault laboratory, students could not only study both the navigation technology by the navigator simulator and astronomical phenomena knowledge by the planetarium simulator, but

also could syncretize navigation technology with astronomical phenomena knowledge much better. Students could master much more abilities, such as chronometer orientation, navigate equipment calibration and adjustment etc. By this way, students' abilities will be improved.

Reference

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