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## Development and Application of Flight Simulator Management Information System Based on Web Technology

Gang Li, Hongzhi Zhang and Zhenguo Ba  
China Academy of Civil Aviation Science and Technology, Beijing, China

**Abstract:** To improve the low efficiency in the flight simulator evaluation management, the flight simulator management information system is developed by using Web technology based on Browser/server architecture. The overall design of the management information systems for flight simulator is developed based on the needs of users. The ASP and SQL Server database technology which is compatible with Microsoft platform is adopted to achieve the performance requirements of the flight simulator management information systems. The system is tested by using the existing system hardware and software and the correctness and operability of the system are validated with the actual project. The flight simulator management information system not only improves the operational efficiency of the simulator evaluation, but also provides reference of information construction for domestic airlines company's training center.

**Key words:** Flight simulator, management information system, B/S architecture, web technology

### INTRODUCTION

A flight simulator is a device that artificially recreates aircraft flight and the environment in which it flies, for pilot training, design, or other purposes. It includes replicating the equations that govern how aircraft fly, how they react to applications of flight controls, the effects of other aircraft systems and how the aircraft reacts to external factors such as air density, turbulence, wind shear, cloud, precipitation, etc. Flight simulation is used for a variety of reasons, including flight training (mainly of pilots), the design and development of the aircraft itself and research into aircraft characteristics and control handling qualities (RAeS, 1992).

Management Information System (MIS) provides information that organizations need to manage themselves efficiently and effectively (Yu *et al.*, 2001). The airlines in the United States and EU countries have set up their own operation and management of information systems. FAA (Federal Aviation Administration) in the United States established a management information system for flight simulator a few years ago and EU countries have their own MIS for flight simulators. These systems provide a great help for them to effected manage hundreds flight simulators.

### FLIGHT SIMULATOR EVALUATION

There are 35 training units in operation and 185 flight simulators in China which belong to the major domestic airlines operating Boeing and Airbus aircraft. These training units usually provide training for their own pilots and help other companies. The national future annual

demand for airline pilots is 2500, so the training task is very heavy and some pilots have to go abroad for training. The situation of flight simulator evaluation from September 1999 to December 2012 is shown in Fig. 1. The cost in foreign countries is much higher than it in China and more flight simulators are introduced, which bring greater challenges to our evaluation management. It is necessary to develop a MIS for flight simulator.

### GENERAL DESIGN

**System analysis:** The original main form of management and problems: (1) The relevant documents and information are transferred by fax or the telegraph form,

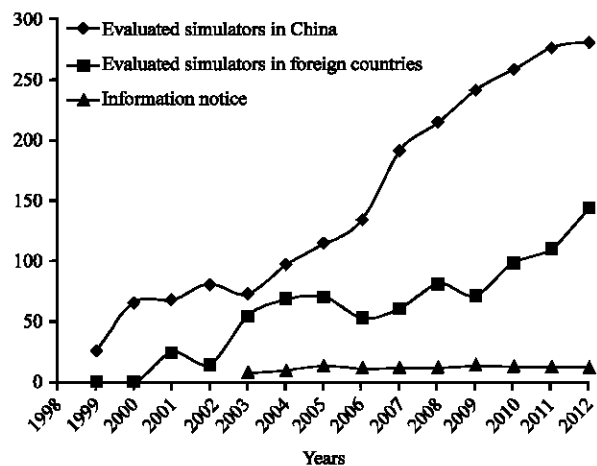


Fig. 1: Flight simulator evaluation from 1999 to 2012

which is not timely; (2) Simulator training centers from start to apply to the evaluation report and certificate by fax, mail or e-mail which is not efficiency; (3) In the simulator quality management system, simulator maintenance quality cannot be supervised in real-time because the information of spare part reserves and fault conditions can't be shared efficiently.

**General architecture design of system:** According to the needs of the flight simulator evaluation management, flight simulator management information system is conceived and designed based on the use of the existing mature computer network technology (Cakir and Canbolat, 2008; Martens *et al.*, 2006). The system is easy to operate, powerful management and can achieve the flight simulator evaluation management, the system through the establishment of seven subsystems can achieve adding information, query, modification functions, the system block diagram is shown in Fig. 2.

According to the actual situation, flight simulator management information system management should be realized that all management are related to the simulator evaluation to avoid the management information attacked by intentionally or unintentionally modify or delete, enhance the system security and manage the users and their privilege. Design of flight simulator management information system function module is shown in Fig. 3.

**KEY TECHNOLOGY**

**Key technology:** The system uses MS SQL Server 2000 database management system as a background. And comparing with small Access database management system, MS SQL Server 2000 is an outstanding representative of the large and medium-sized database

management system (Li *et al.*, 2009; Wang *et al.*, 2000; Zhou *et al.*, 2002). The advantages of MS SQL Server in the enterprise-class management system software is in particular obvious, in the same circumstances, the use of MS SQL Server can lower the burden on the CPU, reduce network traffic and improve data access efficiency (Liu *et al.*, 2004). The operating mechanism of ASP.NET and database is shown in Fig. 4.

**Determination and analysis of entities:** It can be found from the analysis that the information management system of the flight simulator has 19 entities (Li *et al.*, 2006; Tan, 2011). For example, the attributes of a training center is shown in Fig.5.

The system is equipped with Dell PowerEdge R410 server with Microsoft Windows 2003 Server. For normal users; they can look up flight simulator certificate information and relevant regulations. It is shown in Fig. 6.

The flight simulator operator can use the system to submit the evaluation application of flight simulators. It is shown in Fig. 7.

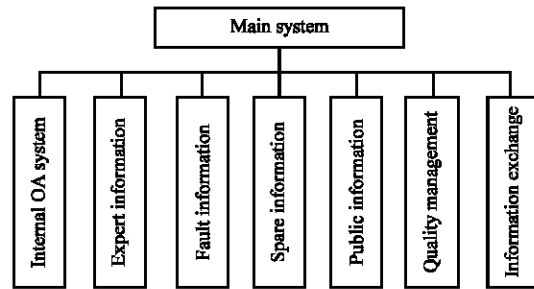


Fig. 2: Block diagram of general design of system

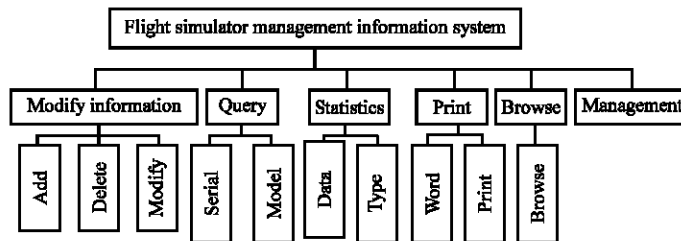


Fig. 3: System function diagram

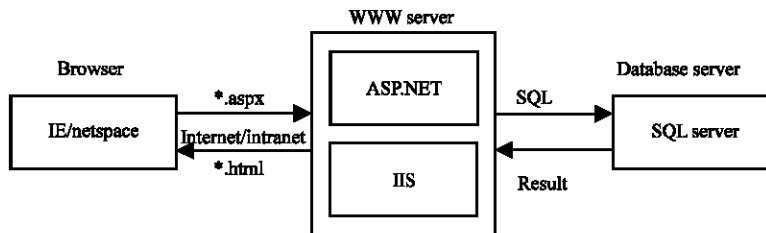


Fig. 4: Operating mechanism of ASP.NET and database

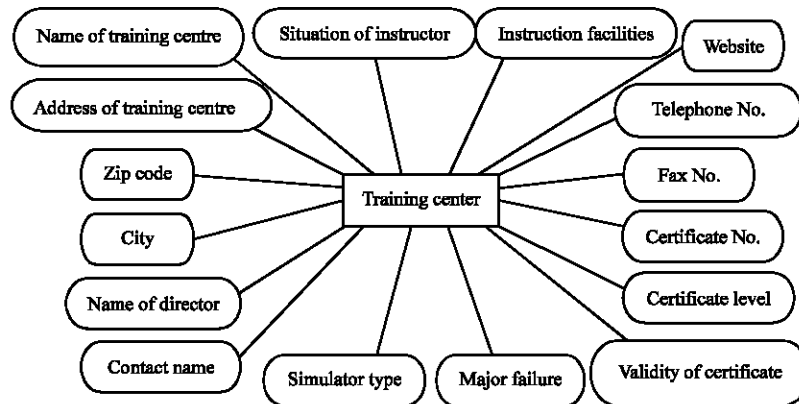


Fig. 5: Training center attributes

设备编号	设备名称	设备类型	模拟机型	鉴定等级	安装地点
FSD-005	B737-NG FFS	全动模拟机	B737-800	D	云南, 昆明
FSD-021	B737-800 FFS #1	全动模拟机	B737-800	D	广东, 珠海
FSD-029	B737-800 FFS	全动模拟机	B737-800	D	四川, 广州
FSD-051	B737-800 FFS #1	全动模拟机	B737-800	D	上海, 浦东

Fig. 6: Flight simulator information inquiry

飞行模拟机训练设备鉴定申请表

模拟机名称: A320 FFS #1

设备编号: FSD-378

设备类型: 全动模拟机

所属的飞机机型: A320XLR

制造厂家: CAE HL

出厂编号: 2902-211

首次鉴定日期:

制造商制造厂家: CAE HL

鉴定系统型号: CAE MAVEE PLUS

运行制造厂家: CAE HL

运行系统型号: CAE 000 Series

申请单位:  CAE  CAE OvrK25  FAA 129-480C

JAA-STDA

Fig. 7: Operator submits the evaluation application

设备编号	运营人名称	模拟中心	设备名称	设备类型	模拟机型	设备状态
分配鉴定任务						
搜索信息						
运营人:		申请时间:				
设备编号	运营人	合格证编号	设备名称	设备类型	模拟机型	鉴定类型
<input type="checkbox"/>	西安中飞航空俱乐部有限公司	FSD-182	Cessna172 FTD	单练器	塞斯纳-C172	定期鉴定
<input type="checkbox"/>	航科网	FSD-378	A320 FFS #1	模拟机	A320-320	初始鉴定
<input type="checkbox"/>	青岛九天国际飞行学院	FSD-077	Cessna 172R FTD #2	单练器	塞斯纳-C172	定期鉴定
<input type="checkbox"/>	青岛九天国际飞行学院	FSD-076	Cessna 172R FTD #1	单练器	塞斯纳-C172	定期鉴定
<input type="checkbox"/>	青岛九天国际飞行学院	FSD-113	DA42 FTD	单练器	钻石-DA42	定期鉴定
<input type="checkbox"/>	上海世翼航空技术有限公司	FSD-181	Gulfstream G550 FFS	模拟机	湾流公司-湾流550	定期鉴定
<input type="checkbox"/>	上海世翼航空技术有限公司	FSD-180	Gulfstream G450 FFS	模拟机	湾流公司-湾流450	定期鉴定
<input type="checkbox"/>	山东航空航空技术有限公司	FSD-179	B737-800W FFS #2	模拟机	B737-800	定期鉴定
<input type="checkbox"/>	新疆天利航空学院有限公司	FSD-149	DA42 FTD	单练器	钻石-DA42	定期鉴定

Fig. 8: Tasks assigned by administrator

设备编号	运营人名称	模拟中心	设备名称	设备类型	模拟机型	设备状态	
鉴定报告审核							
搜索信息							
运营人:		合格证编号:					
设备编号	运营人	合格证编号	设备名称	设备类型	模拟机型	鉴定类型	申请等级
FSD-047	中国民用航空飞行学院	FSD-047	Boeing FTD #2	单练器	波音公司-波音737	定期鉴定	5
FSD-098	中国民用航空飞行学院	FSD-098	Cessna 172R FTD #6	单练器	塞斯纳-C172	定期鉴定	5
FSD-071	中国民用航空飞行学院	FSD-071	Cessna 172R FTD #1	单练器	塞斯纳-C172	定期鉴定	5
FSD-072	中国民用航空飞行学院	FSD-072	Cessna 172R FTD #2	单练器	塞斯纳-C172	定期鉴定	5
FSD-099	中国民用航空飞行学院	FSD-099	Cessna 172R FTD #9	单练器	塞斯纳-C172	定期鉴定	5
FSD-106	中国民用航空飞行学院	FSD-106	Cessna 172R FTD #13	单练器	塞斯纳-C172	定期鉴定	5
FSD-105	四川航空培训中心	FSD-105	A320-200 FFS #1	模拟机	空客-A320	定期鉴定	D
FSD-161	四川航空培训中心	FSD-161	A320-200 FFS #3	模拟机	空客-A320	定期鉴定	D
FSD-114	四川航空培训中心	FSD-114	A320-200 FFS #2	模拟机	空客-A320	定期鉴定	D

Fig. 9: Evaluation reports checked by administrator

System administrator has the highest authority; the overall management of the system can be used flight simulation equipment identification. It is shown in Fig. 8 and 9.

### CONCLUSION

To overcome the difficulty in evaluation of flight simulator, the research background and status of this topic are discussed and the necessity and feasibility of the management information system for flight simulator are analyzed. The overall design of the management information systems for flight simulator is developed based on the needs of users.

The flight simulator management information system is tested by using the existing system hardware and software and the correctness and operability of the system are verified with the actual project.

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