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ТЕСТУВАННЯ, ВАЛІДАЦІЯ ТА ВЕРИФІКАЦІЯ ПРОГРАМНОГО ЗАБЕЗПЕЧЕННЯ

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Electronic Document Management System implemented on the basis of SharePoint 2010. E-Marksheet Management subsystem

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Метою роботи є аналіз існуючих проблем у галузі авіаційних тренажерів та розробка тестового середовища для авіаційного тренажера TL-410. В процесі роботи, був проведений глибокий аналіз проблем, які існують на сьогодні у галузі авіаційних тренажерів. В результаті дослідження виявилося, що при тестуванні авіаційного тренажеру TL-410, який розташований на території НАУ, оператор не може бачити усю необхідну йому інформацію з показників в одному місці, що, у свою чергу, не є зручним. Результати роботи, проведеної у рамках кваліфікаційної роботи, будуть використовуються в Національному авіаційному університеті як частина авіаційного тренажера TL-410. Розробка проводилися під управлінням операційної системи Windows 7. Розробка програмного забезпечення здійснювалася на платформі .NET Framework 3.5 у середовищі Microsoft Visual Studio 2010 на мові програмування C#.

Целью квалификационной работы является анализ существующих проблем в области авиационных тренажеров и разработка тестовой среды для авиационного тренажера TL-410. В процессе работы, был проведен глубокий анализ проблем, существующих на сегодня в области авиационных тренажеров. В результате исследования оказалось, что при тестировании авиационного тренажера TL-410, который расположен на территории НАУ, оператор не может видеть всю необходимую ему информацию по показателям в одном месте, что, в свою очередь, не является удобным. Результаты работы, проведенной в рамках квалификационной работы, будут используются в Национальном авиационном университете как часть авиационного тренажера TL-410. Разработка проводились под управлением операционной системы Windows 7. Разработка программного обеспечения осуществлялась на платформе. NET Framework 3.5 в среде Microsoft Visual Studio 2010 на языке программирования C #.

The subject of study is a development of testing tool for software of aviation simulator TL-410. The aim of qualification work is to analyze the existing problems in aviation simulators and to develop testing tool for software of aviation simulator TL-410. The investigation and analysis of problems that now exist in the aviation simulators industry was performed during the implementation of this work. In the result, there was set that when testing the aviation simulator TL-410, placed at National Aviation University, operator doesn't see all needed information on one display. And this is not very convenient. So there was made a decision to develop a system that will decide this problem. Results of work are to be used in the National Aviation University as part of aviation simulator TL-410. Testing tool is implemented on Microsoft .NET Framework 3.5 SP1 and works under Windows (7, XP, Vista) operating systems. The software is developed using C# programming language in the Visual Studio 2010 programming environment.

Ключові слова: Aviation Simulator, Testing tool, TL-410

Introduction

Aviation simulator is a technical tool that is widely used to improve the skills of operators of aircraft, to retrain crew members, for regular checks of professional knowledge of the crew and to work out of crew cooperation while piloting the aircraft both in regular and in difficult weather conditions.

The National Aviation University has legacy aviation simulator of L-410M airplane that now is reconstructed after many years of stoppage. The specialists are reworking the hardware and software and improving functionality of simulator. So,

a convenient way of testing the developed functionality is needed.

As the aviation simulator software uses specific protocol of data transportation (UDP protocol), the chance to find such a system that will satisfy all needs is rather small. So there was made a conclusion to develop such an environment.

Aviation simulator is a part of flight-training complex, which is used for training pilots and is a complex hardware-software modeling system that imitates the cockpit with the controls and indicators, visual and audio environment of pilots and aircraft behavior when making different phases of flight. (Fig.1.).

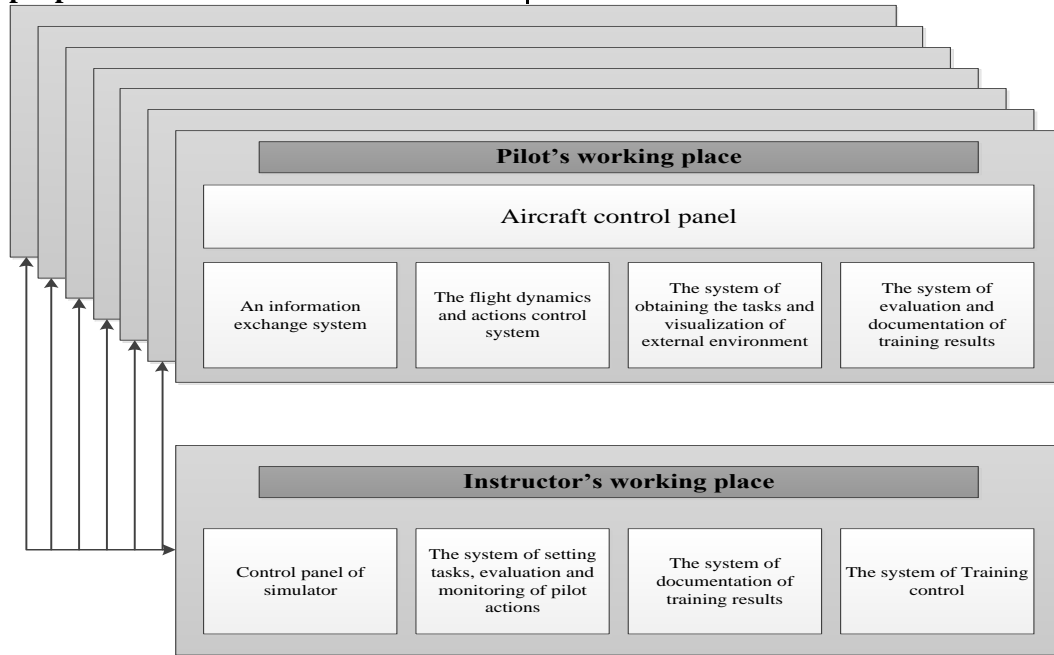**Main purposes of aviation simulator**

Fig.1. Structure of a typical aircraft simulator

Since 1990s aviation simulator, along with aircraft, became a major learning tool for training pilots.

Depending on their purposes, simulators can perform various tasks: initial training of operators, their re-training and support skills, professional selection, solving of design problems, research of equipment and object management systems, processing techniques of their control and also programs and techniques of operators training.

In the modern simulators equipment of operators' workplaces are identical to the real one. Geometrical sizes of cockpit and location of devices, indicators and controls correspond to real conditions.

One of the simulators (TL-410M) is located at the National Aviation University (Fig.2.)
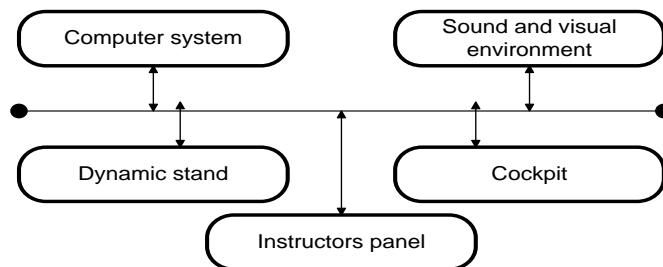.

Fig.2. General schema of simulator

The simulator computer system was built on the basis of computer "ROBOTRON 4201" and

the analogue-digital data exchange system. Listings of the legacy software are presented at the

documentation that includes seven volumes with total amount nearby 32000 LOC. The simulator had got the out-of-order analogue sound surround simulator. For visual environment imitation the television simulator on the face-to-face mono-chrome projective system and the stationary tablet on instructor workplace (coordinators, an airdrome breadboard model) have been used. The instructor panel contained the indicators that duplicate one in a pilot's cockpit and the television receiver for visual environment picture. The pilot's cockpit simulated the cockpit of a real airplane L410.

Problem statement

The National Aviation University has legacy aviation simulator of L-410M airplane that now is reconstructed after many years of stoppage. The specialists are reworking the hardware and soft-ware and improving functionality of simulator. The new computer system of the simulator is distribut-ed and includes several hosts at the network.

Specific properties of simulator TL-410 were taken into account during the development of test-ing tool for it. These specific properties are associ-ated with configuration and location of separate parts of aviation simulator and with using of spe-cific protocol of data transition (UDP protocol). Thus, finding ready-made solution that meets all requirements is a challenging task.

Requirement Specification and Design

The objectives of the software are the simula-tion and monitoring the application network inter-change for the aircraft simulator TL-410 distribut-ed computer system.

Testing tool generates the desired information package with sending to network hosts and receive the packages from the network and visualize it.

Aircraft simulator testing tool together with visual controller should help the manufacturers:

- To develop and test of flight hardware.
- To develop and test of flight software.
- To develop and test of aircraft systems.
- To monitor the results effectively collect-ing all parameters' values on one screen.

It is much safer to develop critical flight soft-ware on simulators or using simulation techniques than it is to develop using actual aircraft in flight.

The developed system has two modes: sending and receiving. In receiving mode, the system re-ceives XML packages from Visual Controller. Packages include name of parameters and their values. In sending mode the operator creates in-formation for these packages on his own, i.e. he sets values for parameters and passes them to Vis-ual Controller. Values can be set manually (via the program interface or in txt file, which is then load-ed into the program) or by using mathematical functions. Operator can also define the list of pa-rameters to send in the package. Operator can also add new parameter to the list of predefined via program interface. This ability makes program more flexible in its usage.

Main components of the system are shown on component diagram (Fig.3). Component diagram depicts how components are wired together to form larger components and or software systems.
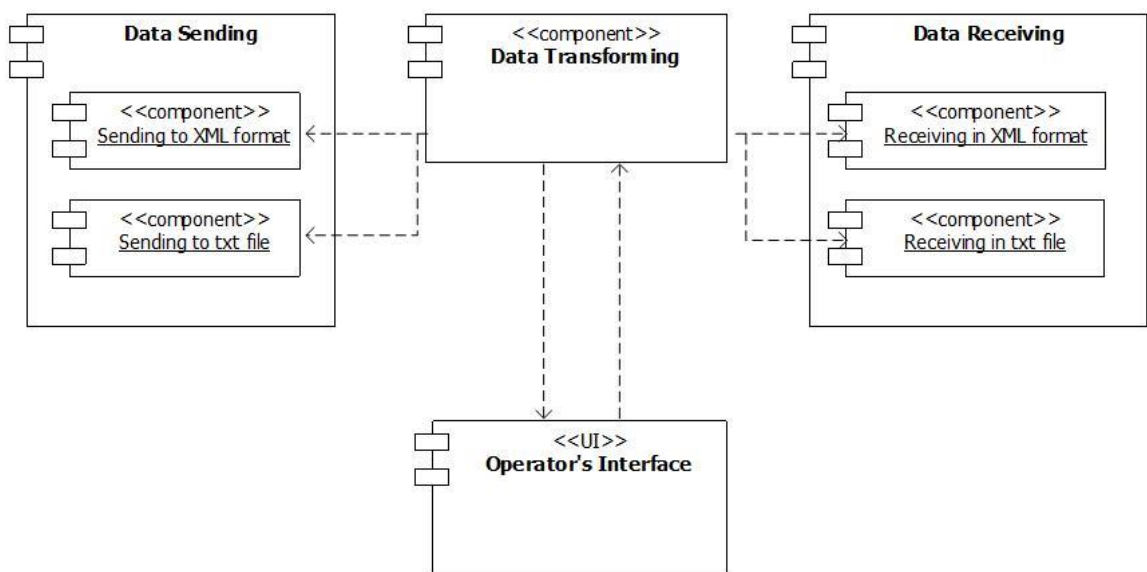

Fig.3 Component diagram

Implementation

Testing tool is implemented on Microsoft .NET Framework 3.5 using C# programming language in the Visual Studio 2010 programming environment.

Packages are transferred using a UDP protocol that allows sending messages (datagram's) via network without requiring prior communications to set up special transmission channels or data paths. To implement the packages transition over the network, System.Net library was used. The System.Net namespace provides a simple programming interface for many of the protocols used on networks today.

To facilitate the management of multiple objects with the same or similar behavior, the Manager Design Pattern is realized in the application. It facilitates the work with parameters, packages and transition packages via a network.

To create instances of each mode and each manager, Factory design pattern was also used. It allows the same instances to be reused instead of recreated each time it is needed.

To implement the functionality of saving parameter's information and loading it to the corresponding fields the next time application is opened, the System.XML. Serialization library was used. It allows serializing and desterilizing objects into and from XML documents. For the implementation of the UI part, Windows Forms technology was used.

Conclusions

The use of aircraft simulators enables to fundamentally change the system of training pilots and other aviation professionals. Typically, for each aircraft type, a separate simulator is created. This is caused by the fact that each aircraft has its own peculiarities of piloting that need to be considered in aviation simulator. As the air transportation industry currently uses aircraft that were constructed several decades ago, the demand for the use of simulators for them also exists. Process of development and maintaining the aviation simulator continues, so the task of facilitating the testing process by developing a testing tool is the topical problem today.

Testing tool shall to generate the desired information package with sending to network hosts and receive the packages from the network and visualize it. Results of work are used in the National Aviation University during the reconstruction the aviation simulator TL-410.

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