A PROTOTYPE OF WEB-BASED SIMULATION ENVIRONMENT (WEBSIM)

By

TAN KEE LEONG

Thesis Submitted in Fulfilment of the Requirements for the Degree of Master of Science in Faculty of Engineering Universiti Putra Malaysia

November 2000

DEDICATION

This book is dedicated to my parents:
Mdm. Koo Kim Lai and my late father Mr.Tan Guat @ Tan Ban Po (1945 – 1998)
– from whom I learned the value of hard work and perseverance.

Abstract of the thesis submitted to the Senate of Universiti Putra Malaysia in fulfilment of the requirements for the degree of Master of Science.

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Chairman : Associate Professor Borhanuddin Mohd. Ali, Ph.D.

Faculty : Engineering

Computer simulation is the discipline of designing a model of an actual or theoretical physical system, executing the model on a computer, and analysing the execution output. Among the popular simulation tools are Mil3 Opnet, Mathworks MATLAB and even self-developed simulation program (using language such as Pascal, Fortran and C/C++). However, these simulation tools have limitations such as platform dependent, expensive cost, maintenance difficulties and limited in reusability.

One of the methods to overcome this limitation is by implementing web-based simulation. Web-based simulation allows simulation to be carried out over the Internet using a standard web browser. The usage of web browsers make the Internet a very user-friendly environment by integrating all related resources into a single tool that eliminates the steep learning curve for novice simulation users.

In this thesis, we present the web-based simulation environment project (Websim). Websim uploads a simulation program (developed using C/C++) in

binary format, generates a web-interface for the program and allows users to access the simulation program via the Internet. The results generated from the simulation program would be translated into an image file. Finally, the image file is embedded into an HTML file, and returned to Websim users. Websim is mainly developed using the combination of CGI and Javascript technologies. The server-side CGI scripts, written in Perl process the various requests from users, while the client-side Javascript is used to perform user inputs validations. Thus, lessen the workload of the server and tightens the security.

Websim is able to receive the simulation program in executable format and provide a web interface for it. This gives the flexibility and convenience of using the programming language of choice for the simulation modeller, and to integrate it with the web. Besides that, Websim also allows the storage of simulation program on a web server, thus could act as an online store for simulation programs. This permits the sharing of simulation program over the Internet, to an exclusive user groups or to the general public. Finally, Websim could act as a teaching tool in school and universities, especially for courses involving modelling and simulation. It allows teaching and learning to be done through the Internet, hence could assist students in having a better understanding on certain topics or concepts.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia untuk memenuhi keperluan ijazah Master Sains.

SATU CONTOH PERSEKITARAN SIMULASI WEB (WEBSIM)

Oleh

TAN KEE LEONG

November 2000

Pengerusi : Profesor Madya Borhanuddin Mohd. Ali, Ph.D.

Fakulti : Kejuruteraan

Simulasi komputer merupakan satu disiplin yang melibatkan proses merekabentuk model sebenar atau model sistem fizikal teori, melaksanakan model tersebut pada komputer, dan menganalisis hasil perlaksanaan model tersebut. Antara perisian simulasi yang popular ialah Mil3 Opnet, Mathworks MATLAB, dan perisian yang ditulis sendiri menggunakan bahasa paras tinggi seperti Pascal, Fortran dan C/C++. Namun, perisian-perisian simulasi seumpama ini mempunyai kelemahan seperti tertakluk kepada pelantaran, kos yang tinggi, kesukaran dalam memelihara serta menyokong perisian, dan penggunaan-semula yang terhad.

Salah satu cara untuk mengatasi kelemahan tersebut ialah dengan melaksanakan simulasi web. Dengan simulasi web, proses simulasi boleh dilaksanakan pada Internet dengan menggunakan sebarang pelayan laman biasa. Penggunaan pelayan laman juga menjadikan Internet satu persekitaran yang mudah, iaitu dengan menggabungkan sumber-sumber yang berkaitan untuk menjadi satu perisian yang senang dipelajari.

Dalam tesis ini, kami melaporkan satu projek persekitaran simulasi web, kami kenali sebagai "Websim". Websim menerima satu aturcara simulasi (ditulis menggunakan bahasa C/C++) dalam format binari, menyediakan satu perantaraan web (dalam bentuk fail HTML) kepada aturcara tersebut, dan seterusnya membenarkan ia dicapai melalui Internet. Hasil daripada aturcara simulasi tersebut akan diterjemah menjadi satu fail grafik. Akhir sekali, fail grafik tersebut dimasukkan ke dalam fail HTML tadi dan dihantar kembali kepada pengguna Websim. Websim dibina menggunakan gabungan teknologi CGI dan Javascript. Aturcara CGI yang ditulis dalam bahasa Perl melaksanakan pelbagai proses di peringkat pelayan. Sementara itu, Javascript digunakan untuk memeriksa input pengguna sebelum dihantar kepada pelayan, dengan itu mengurangkan beban pelayan dan meningkatkan tahap keselamatan sistem pada keseluruhannya.

Websim memberi kemudahan fleksibel kepada pengguna untuk menggunakan bahasa pengaturcaraan pilihan sendiri. Selain itu, Websim juga membenarkan aturcara simulasi disimpan di dalam pelayan web, lantas boleh dijadikan tempat simpanan aturcara simulasi yang boleh dicapai secara langsung. Ini mengizinkan aturcara simulasi tersebut dicapai pada Internet, sama ada kepada kumpulan tertentu yang terhad ataupun kepada semua pengguna am. Akhir kata, Websim juga boleh dijadikan satu alat bantuan mengajar di sekolah dan universiti, khasnya kepada kursus-kursus yang melibatkan pemodelan dan simulasi. Websim membenarkan pengajaran dan pembelajaran dibuat melalui Internet, dan ini akan dapat membantu meninggikan pemahaman para pelajar bagi sesuatu topik.

ACKNOWLEDGEMENTS

I am indebted to several people who have directly or indirectly contributed to this dissertation work. The knowledge and experiences I have gained with them cannot be measured in words. Neither can the appreciation I have for them. The following list, by no means exhaustive, is an attempt to acknowledge at least a few of these people.

To all lecturers, staffs and friends in the Department:

Dr. Borhan
Dr. V. Prakash
Puan Nor Kamariah
Dr. Abdul Rahman Ramli
Puan Roslizah

Chee Boon Kok
Low Wai Yan
Fawwaz
Hadi
Ali
Prihandoko
Choong Khong Neng
Yem Poh Cheang
Fei Wang Li
Ku Day Chyi
Angeline
Michael
Zubeir
Khalid
Mabruk
Abdul Latiff
Haniff
Fizan

Puan Aishah
Puan Salbiah
Puan Rufina
Puan Noorlida
Abang Nor
Uncle Savier

My beloved family members and relatives:

My mother
Lay Ki
Kee Swee
Poay Lin
Poay Phing

Kor Lian
Kor Jin
Kor Peng
Loo Ching
Sze Fei
Ching Ji
Uncle Kee Peng
Auntie Ong
Lina
Lilia
A E Tendong
Siew Kheng
Siew Chin

Uncle Gan
Uncle Wee
Auntie Bee Liang
Uncle Guan Chit
Susi

My housemates and friends in the campus

Bro. Tan Ho Soon
Sek Thai
Sai Tin
Boo Ping
Kah Wah
Cheng Tong
Tien Siong
Shau Meng

Mr.Ong
Wein Leong
Peng Siong
Chong Yong
Babbu

My respectful residents of Kalyana, Mudita, Bodhi, Ananda and Dhammarakha Lodge.

Lai Hsiang
Lewis
Teng Yong
Sheow Foong
Choon Yan
Sau Ping

I share the happiness and joy with all of you!

I certify that an Examination Committee met on 6th November 2000, to conduct the final examination of Tan Kee Leong, on his Master of Science thesis entitled "A Prototype of Web-based Simulation Environment (Websim)" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

ABDUL RAHMAN RAMLI, Ph.D.
Lecturer
Faculty of Engineering
Universiti Putra Malaysia
(Chairman)

BORHANUDDIN MOHD. ALI, Ph.D.
Associate Professor
Faculty of Engineering
Universiti Putra Malaysia
(Member)

VEERARAGHAVAN PRAKASH, Ph.D.
Lecturer
Faculty of Engineering
Universiti Putra Malaysia
(Member)

NOR KAMARIAH NOORDIN.
Lecturer
Faculty of Engineering
Universiti Putra Malaysia
(Member)

MOHD GHAZALI MOHAYIDIN, Ph.D.
Professor / Deputy Dean of Graduate School
Universiti Putra Malaysia

Date:

This thesis was submitted to the Senate of Universiti Putra Malaysia and was accepted as fulfilment of the requirements for the degree of Master of Science.

KAMIS AWANG, Ph.D.
Associate Professor,
Dean of Graduate School
Universiti Putra Malaysia

Date:

DECLARATION

I hereby declare that the thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.

Candidate
Name: **TAN KEE LEONG**

Date: 7 November 2000

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API	-	Application Programmer Interface
AWT	-	Abstract Window Toolkit
CGI	-	Common Gateway Interface
CORBA	-	Common Object Request Broker Architecture
GBN	-	Go Back N.
HTML	-	Hyper Text Markup Language
HTTP	-	Hyper Text Transfer Protocol
IP	-	Internet Protocol
JVM	-	Java Virtual Machine
LAN	-	Local Area Network
ODBC	-	Open Database Connectivity
ORB	-	Object Request Broker
PERL	-	Practical Extract Report Language
RMI	-	Remote Method Invocation
S&A	-	Simulation and Animation
SMTP	-	Simple Mail Transfer Protocol
TCP	-	Transport Control Protocol
GUI	-	Graphical User Interface
UML	-	Unified Modelling Language
VRML	-	Virtual Reality Markup Language
WAN	-	Wide Area Network
WWW	-	World Wide Web