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A LAYERED ARCHITECTURAL MODEL FOR MUSIC EDUCATION: MALAYSIAN MUSIC ON THE WORLD WIDE WEB

MINNI ANG KIM HUAI

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DOCTOR OF PHILOSOPHY
UNIVERSITI PUTRA MALAYSIA

1998

UPM

A LAYERED ARCHITECTURAL MODEL FOR MUSIC EDUCATION: MALAYSIAN MUSIC ON THE WORLD WIDE WEB

By

MINNI ANG KIM HUAI

Dissertation Submitted in Fulfilment of the Requirements for the Degree of Doctor of Philosophy in the Faculty of Science and Environmental Studies
Universiti Putra Malaysia

April 1998

UPM

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LIST OF ABBREVIATIONS

ADC	audio to digital converter
ADPCM	adaptive differential pulse code modulation
ALM	automated link maintenance
AWE	advanced wave emulation
ARPA	Advanced Research Projects Agency
CAL	computer aided learning
CCIT	Comite Consultatif Internationale de Telegraphique et Telephonique
CD	compact disc
CD-ROM	compact disc read only memory
CGI	common gateway interface
CPU	central processing unit
DCE	distributed collaborative environment
DNS	domain name server
FM	frequency modulation
ftp	file transfer protocol
GB	gigabyte
GIF	graphics interchange format
GNP	gross national product
GUI	graphical user interface
HTML	hypertext markup language
http	hyper text transfer protocol
HTTP	Hyper Text Transfer Protocol
IBM	International Business Machines
IO	input-output
IP	internet protocol
IT	information technology
JPEG	joint photographic experts group
KB	kilobytes
Kb	kilobits
Kbps	kilobits per second
LAN	local area network
LC	Library of Congress
LZSS	Lempel-Ziv-Storer-Szymanski
MB	megabyte
MIDI	musical instrument digital interface
MOD	music modules
modem	modulator demodulator

MPEG	motion picture expert's group
MSC	multimedia super corridor
MSIE	Microsoft Internet Explorer
NASA	National Aeronautics and Space Administration
NCSA	National Center for Supercomputing Applications
NNTP	Network News Transfer Protocol
NSF	National Science Foundation
PAL	phase alternating line
PC	personal computer
PCM	pulse code modulation
RAM	random access memory
RCA cable	audio cables made by the RCA company
RGB	red green blue
RILM	Research Institute for Literature in Music
ROM	read only memory
SCSI	small computer system interface
SSI	server-side-includes
TCP	transfer control protocol
URL	uniform resource locater
VHS	very high frequency
VRML	virtual reality modeling language
WWW	world wide web
WYSIWYG	what you see is what you get

Abstract of dissertation presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirements for the degree of Doctor of Philosophy.

A LAYERED ARCHITECTURAL MODEL FOR MUSIC EDUCATION: MALAYSIAN MUSIC ON THE WORLD WIDE WEB

By

MINNI ANG KIM HUAI

April 1998

Chairman: **Associate Professor Abu Talib Othman, Ph.D.**

Faculty: **Science and Environmental Studies**

To date, no research has yet been published on the subject of web architectures for music. The two-layered web architecture for Malaysian music, designed and developed in this study, can be applied as a model of web architecture for music education, specifically for the introduction of the music of a particular country or region. The model is designed and developed in two phases: the building of the subject architecture, or the content development phase; and the design and development of the application architecture. However, no comprehensive classification method for Malaysian music currently exists. Furthermore, information about all the various types of music in Malaysia is not easily available. The research includes the collection of information about Malaysian music from existing data sources and through field research, undertaken to obtain information

about types of music known in Malaysia, but not yet covered by existing publications. This is followed by the design and development of the web application prototype. The complete web architecture is then analyzed and tested to determine its suitability for delivery of music related content.

To aid in the development of the subject architecture, a systematic classification method for Malaysian music is proposed. Data collected is organized according to the subject architecture and digitized for hypermedia presentation. System specifications, design, coding, testing and validation of the prototype application follow. The prototype is implemented on a World Wide Web server. An analysis of the prototype web architecture is carried out, including a functional analysis as well as a usability analysis. Research findings indicate that the web architecture is reliable, efficient and suitable for its purpose, besides being well received by users. It is also easily extensible to include educational modules. The classification scheme proposed is found to provide a logical approach to the study of Malaysian music. Much previously unpublished information, especially in the area of art music, is published through the web site. In conclusion, the prototype web architecture model provides a suitable extensible platform for the delivery of Malaysian music content, which may be packaged for the purpose of music education, or adopted for the introduction of the music of any region.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Doktor Falsafah.

MODEL SENIBINA BERLAPIS UNTUK PENDIDIKAN MUZIK: MUZIK MALAYSIA DI JARINGAN SEDUNIA

Oleh

MINNI ANG KIM HUAI

April 1998

Pengerusi: **Profesor Madya Abu Talib Othman, Ph.D.**

Fakulti: **Sains dan Pengajian Alam Sekitar**

Setakat ini, hasil penyelidikan mengenai senibina jaringan untuk muzik masih belum pernah diterbitkan Rekabentuk dan pembangunan senibina jaringan berlapis-dua untuk muzik Malaysia boleh digunakan sebagai model untuk senibina jaringan bagi pendidikan muzik, khususnya untuk memperkenalkan muzik dari negara atau kawasan geografik yang tertentu. Model direkacipta dan dibangunkan dalam dua fasa: pembinaan senibina perkara, iaitu organisasi isi kandungan yang hendak dipersembahkan; dan rekabentuk dan pembangunan senibina perisian. Sistem klasifikasi untuk muzik Malaysia masih belum wujud. Maklumat mengenai semua jenis muzik di Malaysia sukar diperolehi. Penyelidikan termasuk pengumpulan maklumat mengenai muzik Malaysia dari sumber data yang sedia ada dan juga melalui kajian penyelidikan, dijalankan untuk mendapatkan maklumat mengenai muzik yang diketahui wujud di Malaysia, tetapi belum dicatat atau

diterbitkan. Ini diikuti dengan rekabentuk dan pembangunan prototaip. Senibina jaringan yang lengkap dianalisis dan diuji untuk menentukan kesesuaiannya sebagai medium penghantaran maklumat muzik.

Kaedah klasifikasi yang sistematik untuk muzik Malaysia dicadangkan, untuk membantu pembangunan senibina perkara. Data yang dikumpulkan disusun mengikut senibina perkara dan didigitkan untuk persembahan hipermedia. Ini diikuti oleh spesifikasi sistem, rekabentuk, pengkodan, pengujian dan pengesahan prototaip. Prototaip dilaksanakan pada pelayan Jaringan Sedunia. Analisis senibina jaringan prototaip dijalankan, termasuk analisis fungsi dan analisis penggunaan perisian. Hasil penyelidikan menunjukkan bahawa senibina tersebut boleh dipercayai dan cekap, sesuai untuk tujuannya, serta menerima sambutan yang baik daripada pengguna. Ia juga mudah diperluaskan untuk memasukkan modul pendidikan. Skema klasifikasi yang dicadangkan membekalkan suatu pendekatan yang logik kepada pelajaran muzik Malaysia. Banyak maklumat yang sebelum ini belum pernah diterbitkan, khasnya dalam bidang muzik seni, diterbitkan melalui perisian jaringan ini. Kesimpulannya, model senibina yang dibangunkan adalah sesuai untuk penghantaran maklumat mengenai muzik Malaysia, yang boleh dipakejkan untuk tujuan pendidikan, atau digunakan untuk menerbitkan maklumat mengenai muzik mana-mana negara atau kawasan geografik.

CHAPTER I

INTRODUCTION

Malaysia's information technology (IT) development policies and the development of the Malaysian *Multimedia Super Corridor* (MSC) is aimed to move the country to the status of a developed nation by the year 2020. Use of Internet technologies is becoming increasingly widespread, both at work and at home. In keeping with this trend, an increasing number of schools are also being provided with support for Internet access in the classroom, by the government. The above developments are likely to affect the national culture of any country. A need emerges, therefore, to disseminate information about the cultural background of the nation, to maintain the cultural integrity of the society. Music is an important element in this respect, as it has been shown that music plays a significant role in nation building (Ang, 1996; Tame, 1984). Information on Malaysian music is however not easily available to the public.

Many researchers have published material on music in Malaysia, but exactly what constitutes "Malaysian" music has yet to be defined. Material

presenting an overview of all types of music prevalent in the country is not easily available. One such resource, (Matusky & Tan, 1997) is available, but is published in the Malay language, thus limiting its audience. Lockard's 1991 overview article on modern Malaysian music (i.e. popular music), also touches on various other genres present in the country. However, neither of these resources are easily available to the public, and both lack detailed information on certain types of music in Malaysia, especially art music, information on contemporary Malaysian art music composers, and the music of the Indian community in Malaysia. A systematic method of classifying and describing Malaysian music is also lacking. Classification of information is important for the learning process (Tunks, 1992). Matusky and Tan (1997) do discuss the different types of music in the country, but stop at defining five categories of music: classical music, folk music, syncretic music, contemporary art music and popular music. The relationship between these types of music is also not rigorously stated. Four specific needs therefore emerge from this state of events: the need for a definition of "Malaysian" music; the need for a classification system for this music; the need for more information on the various types of music practised in the country, but not yet documented; and the need for publicly available general introductory material on Malaysian music.

Studies have shown that the computer is a very useful medium of instruction in the teaching of music (Lee, 1994; Chen & Dennis, 1993; Conant 1988; Heath, 1982). Music, being one of the elements of a cultural identity, has been taught at primary school level for many years now (Johami, 1990), and has recently also been

introduced at the secondary school level in Malaysia (Ang, 1995). However, there is a shortage of trained teachers and teaching materials. Since the schools have been provided with easy access to the Internet, an interactive on-line multimedia application for instruction on Malaysian music, if developed, can be of significant use in the Malaysian schools context. This application can be used both as a teaching aid and as a resource material for the classroom music teacher, and also as the primary or even sole means of learning about Malaysian music, in schools where a trained music teacher may not be available.

An effective interactive multimedia computer-assisted instruction system should be developed based on the content to be communicated to the learners (Tu & Pai, 1996). The design and development of the web architecture for Malaysian music is therefore dependent on a well structured and logical subject architecture, reinforcing the need for a comprehensive classification system for Malaysian music. The classification system, if proposed, can be used as the basis for the categorisation and organisation of information on Malaysian music [the subject architecture]. The subject architecture thus designed is used to develop the application architecture.

The work involves the design and development of a suitable web architecture (Ang et al, 1997) for dissemination of information (Ang, 1997) on Malaysian music, over the World Wide Web. The web architecture designed is a two-layered architecture, comprising the visible or apparent layer, which is

determined by the subject architecture; and the file storage structure or underlying layer, i.e. the application architecture. The work thus consists of two primary sections: research on Malaysian music and the building of the subject design architecture, which in turn provides a framework for the application architecture; and the prototype application architecture development.

A quick look around the WWW reveals that many web sites exhibit poor implementation, being merely hypertext mark-up language (HTML) versions of printed information. Many on-line companies have sprung up specifically to address the need for structured web architectures (Beart, 1997; @URL, 1997), providing [chargeable] site design and restructuring services. The MUSE CD-ROM (1997), which contains the RILM abstracts of music literature and the Library of Congress music catalogue, reveals that as yet no research has been published on the subject of web architectures for music. The two-layered web architecture for Malaysian music, designed and developed in this study, can therefore be applied as a model of web architecture for music education, specifically for the introduction of the music of a particular country or region.

The subject architecture is reflected in the hierarchy of the web pages contained in the application. The application architecture reflects the subject architecture, but does not mirror it exactly. Design principles adopted include hardware independence, portability, modularity, maintainability, scalability, distributed architecture, open system, and efficiency of coding.

Impact of the Study

The fast paced growth of computer technology in both the fields of music and global networking create a demand for research in this area. The work carried out broadens the present scope of documentation on Malaysian music, besides contributing a new comprehensive classification method, and also contributes towards the wider application of computers in the field of general music education. The impact of the study is itemised in the following paragraphs.

1. No comprehensive classification method for Malaysian music exists yet. The comprehensive classification method proposed in this work (Chapter III) is important for two reasons: it provides a systematic organisational structure for the subject of Malaysian music, which facilitates learning and also further research into the topic; and it provides the basis for the subject architecture, i.e. the visible layer of the web architecture for Malaysian music.

2. There is currently a lack of comprehensive resource material on Malaysian music. One of the aims of the present work is to make available such a resource, which can be used by those seeking such information. Another contribution of the present work is to provide documentation on certain topics in Malaysian music, which are not yet documented.

3. The comprehensive hypermedia resource on Malaysian music will be designed and made available through the WWW (Ang, 1997). The Malaysian government IT development policy and the objectives of the MSC suggest that not only websites and resources about technology, government and business are to be developed, but also websites and resources about arts and culture are also to be promoted. This balance between the arts and the sciences is important if a holistic development is to be achieved. The Malaysian music web site therefore provides a web site which is in line with Malaysian needs.

4. An on-line music education resource is designed and made available for use by Malaysian schools, which have recently introduced general music education at secondary school level, besides also being provided with Internet access in the classroom. This resource will thus be of immense use in the Malaysian schools context, both as a teaching aid and also as a resource material for the classroom music teacher. In view of the current shortage of trained music teachers in Malaysian schools, it may also be used as the primary or even sole means of learning of Malaysian music in schools, where a trained music teacher may not be available.

5. The distributed collaborative environment (DCE) is introduced in a limited sense which seeks to compile on-the-fly, and present in a consistent aesthetic layout, multimedia data distributed geographically, but available through co-

operative efforts This is significant because it is envisioned that in future information may not be as freely available as at present, perhaps due to copyright law or other developments Such a system would therefore save costs as well as contribute towards the development of a collaborative learning environment for music education in general

Definitions of the various terms mentioned in the text are included in Appendix Λ

Statement of Problems

The research objective is to design and develop a web architecture for the delivery of content on Malaysian music, which can be used as a model of web architecture for the delivery of content on the music of any nation As discussed in earlier paragraphs, as yet no research has been published on the subject of web architectures for music The web architecture model therefore needs to be designed and validated The layered architecture needs to be designed in two phases the building of the subject architecture, or the content development phase, and the design and development of the application architecture The first phase addresses two main problems 1) no comprehensive classification method for Malaysian music currently exists, so one must therefore be proposed, and 2) information on all the

various types of Malaysian music is not easily available, so besides compiling information from existing data sources, field research must be undertaken to obtain the comprehensive range of data to be used in the proposed on-line resource The second phase of the work calls for the organisation of data collected during the first phase into a suitable [subject] architecture, which will provide the basis for the web application architecture. The application development phase begins with the definition of the application architecture, taking into consideration the open, distributed nature of the Internet, and the nature of the hypermedia content to be included. This will include identifying system specifications and the web architecture design. Subsequent implementation of the design will be carried out by setting up a prototype application on a WWW server which will be made available to the Internet community for interactive exploration of Malaysian music

Design of the Study

The various methodologies used in the study are first described, including the system development procedure, the music classification system, the data collection methodology, and the web development methodology Design and development of the two layered architecture follows, in two phases, as described in the previous section.

The content development phase of the work involves the gathering of data from previously published sources such as books, journals, cassette and music CD recordings, as well as gathering of original data through field research in the form of information, photographs, video and audio recordings. Data on the various Malaysian cultural communities is gathered to prepare a holistic and well balanced picture of Malaysian music, representative of the main ethnic groups within the country and reflective of the multicultural nature of the society. Previously published data is obtained from various repositories, including local university libraries, bookstores and music stores. Original data is gathered from field trips to selected sites where specifically-Malaysian music making is known to take place. The locality of such sites is determined through various local authorities involved in Malaysian music, such as the Ministry of Culture and the Cultural Centres of the various local universities. The data thus gathered is organised into a coherent architecture, the objective being to present the user with an easily understandable introduction to all the various types of music in Malaysia.

The application development phase of the work can be broken down into several sub-stages: the preparation of a dedicated WWW server, data preparation, application design and development, coding, implementation and testing. Issues to be addressed include the definition of the purpose of the application and its general goals and necessary features, and the specification of various key parameters such as: types of information to be processed, the functions and performance desired from the application, the interface to be established, specific design constraints, and