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Video Content Adaptation Based on User Preferences and Network Bandwidth

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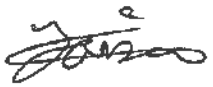

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DECLARATION

I certify that this thesis and the research to which it refers are the product of my own work and that any ideas or quotation from the work of other people, published or otherwise are fully acknowledged in accordance with the standard referring practices of the discipline.

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ABSTRACT

The diversity of multimedia presentation environment sets strict requirements for multimedia applications and systems. Since the invention of the computer, content has been tailored towards a specific device, mainly by hand. Mobile device have become very widespread in recent years. However, the differences in processing power, storage and display resolution of mobile terminals will lead to some problems that the same content is sent to heterogeneous terminals. Offering mobile services to nomadic users involved the limited display and networking capacity of the mobile devices. Although content adaptation techniques have been extensively studied for mobile computing systems in last decades, most of the previous work focused on adaptation with respect to terminal capabilities. Yet, video adaptation is still a challenging field. With the increasing amount of video formats, attention turned towards transcoding video from one format to another in order to make the video compatible with the new usage environment. Thus, the personalization of the service, access a nomadic user's system according to their preferences and network bandwidth based to their needs is a proposed solution. The personalization is using an agent-based approach. System architecture was designed and implement in video adaptation algorithms development. Through the algorithm, rule-based technique was used. Based on the experiment results, it is proved that the video content adaptation under e-learning environment can be achieved by the algorithms effectively.

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LIST OF ABBREVIATIONS

3G	refers to the third generation of developments in wireless technology
3GP	Multimedia File
ASF	Datafile (STATGRAPHICS) Screen font (Lotus 1-2-3)
AVI	Audio Video Interleaved
DCT	Discrete Cosine Transform
FLV	Flash Video
GPRS	General Packet Radio Service
JPEG	Joint Photographic Expert Group
MOV	QuickTime Video Clip
MPG	Mpeg animation
WAP	Wireless Application Protocol,
WiFi	Wireless Fidelity
WMV	MS Active Streaming file

CHAPTER 1

INTRODUCTION

1.1 Introduction

The diversity of multimedia presentation environment sets strict requirements for multimedia applications and systems. Since the invention of the computer, content has been tailored towards a specific device, mainly by hand. The trend is to offer services anytime, anywhere, and with any device. Providing a tailored content and presentation for different clients in heterogeneous environments is becoming increasingly important today. In recent years, with great advantage both to the content provider and the end user, it has been said that this trend of multiple devices, multiple content (MDMC), is slowly shifting towards multiple devices, single content (MDSC) (Giacomo et al., 2004). Thus, emerging growth of mobile services defines more requirements for the content and service providers.

The uses of mobile devices have become very widespread in recent years. It has been said that mobile devices have become an integral part of human everyday life (Lazar, 1994). A set of demands for separate service creation process involve content, terminal capabilities, and underlying network. Besides, mobile services require support for new billing and profiling mechanisms based on the user and the service at hand. Users often try to adapt their devices to their personal preferences in order to remain individual and unique. Mobile phone interface has been built to be intuitive and usable to users.

These mobile devices have also become more capable in terms of computing power and features. Besides than talking, more processing power and memory, addition to software support and high- resolution color screens, are examples of technological advances that make the mobile devices more usable. More and more years, the mobile devices become more updated. Now, the new mobile devices such as small palm computers, smart phones, pocket PCs became common components of the computing infrastructure. As mention by Lazar (1994), according to the some estimates cited by the World Wide Web Consortium (W3C), in future, 75% of the web content access will be soon generated by these devices rather than by desktop personal computer (PCs). At the same time, in order to meet client, server and network constraints, content delivery practices will face new challenges regarding exchange protocols and the accompanying strategies (Lazar, 1994).

1.2 Project Background

The mobile devices will soon be the most popular consumer device in the planet (Madan, 2006). Almost all current mobile devices now allow installing background images, ring tones, or even complex themes, which change the entire appearance of the user interface. Added by Madan (2006), lately, demands for mobile services with specific capabilities to provide various sized video has been increasing. User can select their choice based on the one most likely to run best, and even different formats have been provided in order that it can run on different types of machines. This highly motivating goal can only be achieved within the framework of standardization.

Metso (2002) mentioned that, video with only a single content which is usually in a high quality need to be provided for an entire suite of devices. Moreover, the user is provided with content that is optimized and fits not only the requirements of the device, but the network, and the user's own, often specific, preferences. Since every piece of information needs to be authored for every type of terminal with the associated protocols, these situations poses a serious problem to web designers and maintainers (Layaida and Lemlourna, 2003).

One of the basic requirements is to propose a theory of learning for a mobile society (Vavoula et al., 2002). It encompasses both learning supported by mobile devices such as cellular (mobile) phones, portable computers and personal audio players, and also learning in an era characterized by mobility of people and knowledge (Rheingold, 2002) . As mention by Vavoula, et al. (2002), mobile learning is special compared to other types of learning activity. The difference is that it starts from the assumption that learners are continually on the move.

Thus, the conditions of a minimal knowledge about the different entities that compose the content delivery chain specifically the client, server, document and media resources, etc. are needed. Starting from such knowledge, adaptation mechanisms and content negotiation strategies could be applied to deliver to the target client a content that takes advantage of its capabilities and satisfies its constraints. The negotiation and adaptation core, called NAC, is an architecture developed in order to provide a solution for the delivery of multimedia content in heterogeneous environments (Layaida and Lemlourna, 2003).

1.3 Problem Statement

A major issue in offering mobile services are provides the services to the nomadic users (Lazar, 1994). Offering mobile services to nomadic users involved the limited display and networking capacity of the mobile devices. The basic challenges of wireless wide-area communications is the Quality of Service (QoS) in network bandwidth such as line rate, delay, throughput, round-trip time, and error rate may change dramatically when a user moves from one location to another.

Mobile devices often have small screens which make it difficult to view lots of pages filled with information. Small displays and their properties bring out many new limitations, for example interruptions might be happen during the downloading. Therefore, it is not wise to download such images over a low throughput wireless link, especially when users must pay for transmitted data, which is sometimes it is mostly unusable to the users.

Cha et al. (2005) mentioned that some customers prefer "simplicity", whilst others are "highly cost-conscious". These different preferences and needs may be crucial in terms of usability. It is approved that different users have different usability criteria. Evidence of these different preferences is seen in difference in the most popular mobile handset manufacturer in each country, whereas Nokia is most popular in Europe, meanwhile Samsung is in Korea (Cha et al., 2005).

Thus, the personalization of the service, access a nomadic user's system according to their preferences and network bandwidth based to their needs is a possible solution for this.

1.4 Objective

The objectives of project are:

1.4.1 To design and implement an architecture of server-based video content adaptation.

1.4.2 To develop and implement the video content adaptation algorithm based on the user preferences and network bandwidth.

1.4.3 To evaluate the video content adaptation algorithm based on the user preferences and network bandwidth.

1.5 Scope of work

This project is limited to several scopes as:

1.5.1 The server-based approach is chosen in designing and implementing the content adaptation architecture.

1.5.2 The video content adaptations will cover the image and the text for user interface, including the video sound.

1.5.3 Several mobile devices, such as hand phones are use for testing and implementation.

1.6 Significant

As the development of this prototype complete, the prototype will be extended into a full usable system .This project would give benefits to many parties especially to the university, future researchers, and the users themselves.

1.6.1 User

The proposed system allows mobile users to exploit many different services from a various set of providers according to their profiles, by only using their personal devices like PDA, PC or mobile phone. Besides, for the nomadic users, this will helping them more in achieving the information easier, and reduce their cost and spent time.

1.6.2 Future researchers

Realizing that technological innovation needed to play a key role and the web content adaptation technology still new and not widely used. Perhaps, this project can be used as on of the references to other researchers.

1.6.3 University

As for the university, this system will help the university envision meeting its challenge to become a world class university.

1.7 Summary

In this chapter, the introduction, the background of the project, the problem statement and the project objectives has clearly explained. The scope of the project and the significant of this project also have been described. The next chapter of this project will be about the literature review of the project, the research methodology, the implementation of the system architecture and algorithm development, results and finding and lastly the limitation and the recommendation of this project.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The literature review segment presents the related literature on several areas of study. This is includes the definition of terms involved, a brief description of some video content adaptation, user preferences, network bandwidth, mobile learning, agent-based and other related issues.

2.2 Definition of term

2.2.1 Video Content adaptation

Video is the technology of electronically capturing, recording, processing, storing, transmitting, and reconstructing a sequence of still images representing scenes in motion (Rocchi and Zancanaro, 2003). Video technology was first developed for television systems, but has been further developed in many formats to allow for consumer video recording. Video can also be viewed through the Internet as video clips or streaming media clips on computer monitors.

Content adaptation is the action of transforming content to adapt to device capabilities (Metso, 2002). Content adaptation is the process of transforming the representation of content, such that it is accessible by many different devices or in many different formats (Madan, 2006).Content adaptation is usually related to mobile devices that require special handling because of their limited computational power, small screen size and constrained keyboard functionality.

Content adaptation could roughly be divided to two fields, which are media content adaptation that adapts media files and browsing content adaptation that adapts Web site to mobile devices.

Content adaptation is not just about adapting to the device, but also the user, the network, etc. (Lewis, 2003). Content adaptation process will figure out which content is appropriate for which users and delivering appropriate content on the fly (Pu, 2004).

Thus, video adaptation in terms of the relevance of the objects detected in each frame has been addressed for video surveillance applications (Bertini et al., 2004).

2.2.2 User preferences

Preference is a concept, used in the social sciences, particularly economics (Cha et al., 2005). It assumes a real or imagined "choice" between alternatives and the possibility of rank ordering of these alternatives, based on happiness, satisfaction, gratification, enjoyment, utility they provide. More generally, it can be seen as a source of motivation. In cognitive sciences, individual preferences enable choice of objectives or goals.

Thus, the user's preferences can be basically defined in terms of viewing the quality and service costs. However, preference can be interpreted as a hypothetical choice that could be made rather than a conscious state of mind. In this case, completeness amounts to an assumption that the user can always make up their mind whether they are indifferent or prefer one option when presented with any pair of options.

2.2.3 Network bandwidth

Bandwidth in computer networking refers to the data rate supported by a network connection or interface (Bethel and Shalf, 2003). One most commonly expresses bandwidth in terms of bits per second (bps). The term comes from the field of electrical engineering, where bandwidth represents the total distance or range between the highest and lowest signals on the communication channel (band).

Bandwidth represents the capacity of the connection. The greater the capacity, the more likely that greater performance will follow, though overall performance also depends on other factors, such as latency.

Network bandwidth is not the only factor that determines the "speed" of a network as perceived by the end user. The other key element of network performance, latency, also affects network applications in important ways.

2.2.4 Mobile learning

M-learning, or "mobile learning", now commonly abbreviated to "mLearning", has different meanings for different communities. The term covers:

2.2.4.1 learning with portable technologies, where the focus is on the technology (which could be in a fixed location, such as a classroom.

2.2.4.2 learning across contexts, where the focus is on the mobility of the learner, interacting with portable or fixed technology.

2.2.4.3 learning in a mobile society, with a focus on how society and its institutions can accommodate and support the learning of an increasingly mobile population.

Although related to e-learning and distance education, it is distinct in its focus on learning across contexts and learning with mobile devices. One other definition of mobile learning is a learning that happens across locations, or that takes advantage of learning opportunities offered by portable technologies.

2.2.5 Agent-based

In computer science, a multi-agent system (MAS) is a system composed of several agents, collectively capable of reaching goals that are difficult to achieve by an individual agent or monolithic system. Agents belong to different types, such as interface, travel guide, educator, event handler, services, assistant and personalized assistant (Pavlos et al., 2002).

As mention by Moraitis et al. (2003) agents can be called as personalized assistant. It is the most complex role and it serves a registered user, stores and manages his/her profile and personal data and uses the requests' history in order to adapt the services to his/her habitual patterns. Meanwhile, based can be define as being derived from.

The exact nature of the agent-based is a matter of some controversy. They are sometimes claimed to be autonomous. Furthermore, the more important the activities of the agent are to humans, the more supervision that they receive. In fact, autonomy is seldom desired. Instead interdependent systems are needed.

Since these agents are anonymous, they are just logged and identified by their IP addresses, which is the only information kept about them. These agents can complete some tasks and can also upload files (such as pictures) to most topic pages, move and rename most topic pages, and start new articles on any topic.

2.3 Types of Content adaptation Approach

The W3C defines Content Adaptation as a process of selection, generation or modification of content to suit the user's computing environment and usage context. It means that content adaptation transform a content into one or several partial content according to information about device capabilities. It can be applied to transformation within media types, such as reducing image size or resolution, and across media types, like converting video item to image montage (Metso, 2002).

Adaptation can be applied using three approaches which are at the client end, on the server or in an intermediate proxy between the client and server. In the client end model, the required transcoding is performed by the client device in specific, the mobile browser. In this model, content authors do not need to create different versions of the content since the same content can always be used to display in different devices.

In the server-based approach, content adaptation is added as one of the functionalities of the traditional web server. The content is adapted before delivered back to the requested client, thus reducing the transmission time and client processing time (Mohan et al., 1999). Traditionally, multiple variant of the same content are stored in the server. These content are selected based on matching client identification. One common implementation of providing content to various devices is to store the content as Extensible Markup Language (XML) and use Extensible Style Language Transformation (XSLT) to convert the content to appropriate markup languages. Generally, it is a good idea to separate the content from the presentation.