Multimedia University: A Paperless Environment to Take the Challenges for the 21st Century

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Predictability of absolute data transaction for real time information and reduction of incalculable data delivery time are the major factors to lead the global education as well as economic system towards a paperless environment. Some universities such as the University of Phoenix, Western Governors University, UK Open University, University of California, and Hong Kong University are playing a pioneering role to achieve this paperless environment in the respective campuses. Multimedia University (MMU) is a very distinctive university and is considered the jewel of Malaysia’s bold plan to enter the world arena of 21st century information technology. The university is now operational with intelligent building systems, wireless technology system, satellite tele-education, a digital library, state-of-the-art learning, and research facilities, as well as an integrated computer education management system. MMU runs a paperless administration with the full-fledged e-governance having all these facilities. E-governance is about the use of information technology to raise the quality of the services organizations deliver for its management. The university also provides a Registry of Graduates homepage that not only eliminates fraud, but also complements the e-governance
system, preparing itself for a truly web-based society. This article mainly aims to illustrate the development of higher education in the Multimedia University by establishing a paperless environment.

The ideal paperless environment for education and business is a paperless one using electric means to transact business. With the ever-expanding application of computers into educational and business areas, it seemed in the early 1980s that the real paperless environment was just around the corner. Ironically, just the opposite has transpired. The ease of using computers to print all sorts of documents has created a flood of new paper. Creating a paperless environment involves electronic documentation as a data processing form, in a word processing document, as a digital image, and so forth, and submitting or uploading it directly into the claim file either in its original form or in the previous printed form. In this modern world, educational institutions have stood up and unanimously rejoiced at the opportunity to save cost. The aim is to cut back, trim expenses, and bring technology into a collaborative innovation state where it can work for the educational system (Young, 2002).

Many organizations that promote paperless environments have not yet achieved the Nirvana they seek. Organizations need to understand the reasons for using paper (files, storage, record keeping, mailings) before they promote or suggest a technical solution (knowledge management, data warehouse, storage area networks). That is why real paperless environments must begin at the cultural level so that organizations can understand its necessity and importance. To change the culture and promote paperless environments, organizations need to introduce the culture to new methods of viewing, reading and transiting information and learning contents (Young, 2002). As a challenge for the 21st century, Multimedia University (MMU) has approached new ways of using learning information with proper technological solutions (knowledge management, data warehouse, and storage area network). Besides MMU, this article will also focus on some other universities that have taken the challenge to turn their campus paperless.

The University of Hong Kong (HKU), as a preeminent international university in Asia, seeks to sustain and enhance its excellence as an institution of higher learning through outstanding teaching and world-class research to produce well-rounded graduates with lifelong abilities to provide leadership within the societies they serve. The University has produced a
blueprint in the form of the Millennium Master Plan (MMP; http://www.hku.hk/spuweb/edp/mmp.htm) to meet long-term future planning priorities. A major planning priority for the university is to create a campus and campus experience consistent with the University’s expectation of excellence through e-learning.

Truly a university without boundaries, Western Governors University (WGU; http://www.wgu.edu/about_WGU/overview.asp) is a nonprofit university. When considering an online degree program, students want high-quality academic content that’s relevant to a career, tuition that’s affordable, flexibility that fits a lifestyle, and a strong support system to help one stay on track; in this area, WGU stands out. Founded in 1976, the University of Phoenix (UOP; http://www.uopxonline.com/aboutus.asp) was one of the first accredited universities to offer an online college education with complete degree programs through the Internet. Commitment to educational excellence and unsurpassed student service has made it the leading accredited university offering online courses in the United States.

MMU is a very young university, but the fastest growing university in Malaysia in the area of Engineering and Information Technology. MMU is the first private university approved by the government. The Ministry of Education established it upon invitation in July 1996. MMU is currently based on technological education such as Electrical Engineering, Creative Multimedia, and Information Technology. The university currently has four faculties, which are divided into departments to train and educate students towards the right and precise path. The course structure is up-to-date with both other good universities in the world and the current technology. MMU has specialized laboratories to train students practically and conduct research and development. The university also strives to become the centre of excellence in research and development within the Asia Pacific region, and eventually achieve global recognition. In its effort to enhance the research and development activities, the university has identified key areas and formed centres of excellence around them. The main objective of the centres is to group academics and students with similar interests in a specified field of research to start working on identified research projects. Currently, MMU boasts of 25 centers of excellence spanning areas such as High Speed Broadband and Networking, Virtual Reality and Computer Graphics, E-Commerce, Innovative Education, Computer Animation, and Interpretation and Expression, with more to come. It has a high-speed
network with other universities and institutions to perform live videoconferences and distance education. Several administrative and nonadministrative departments play a vital role in keeping the university steady with its activities (MMU information at http://www.mmu.edu.my/).

This article presents the university structure, the initiatives taken by MMU towards establishing a paperless environment as a challenge for the 21st century, a comparison study that shows the current state of MMU towards reaching a complete paperless environment, a comparison study with other universities to show the current progress of MMU towards a paperless environment. The article also gives some future recommendations for enhancing the current paperless environment at MMU.

STRUCTURE OF MULTIMEDIA UNIVERSITY

MMU, which has two campuses, one in Cyberjaya and the other in Melaka, has so far managed a capacity of more than 20,000 students from diverse communities, pursuing undergraduate and postgraduate studies. MMU Melaka Campus is a twin sister campus, which is strategically located in the vicinity of serene residential areas, booming industrial sites, and the scenic “Ayer Keroh” tourists spots. Being the first government approved and twin campus private university in Malaysia, MMU plays an important role in providing world-class education, market driven programs, and innovative delivery systems. The Cyberjaya campus was established in 1999. It is also the centerpiece of the city of Cyberjaya established as a part of Malaysia’s Multimedia Super-Corridor (MSC). Promising to be the city of the future, Cyberjaya is the home ground for many information technology and technology companies. The city was prewired, before it was built, with a next–generation 2.5-10 gigabyte multimedia network. Like the city, the buildings in the designated MMU Cyberjaya campus are wired with fiber optic cable to enable the availability of broadband applications. The fiber linkages are monitored 24-7 by Telekom, Malaysia’s Central Exchange in Cyberjaya. Commencing its operation in June 1999, this Information Communication Technology (ICT)-driven campus is equipped with intelligent building systems, a wireless technology system, satellite tele-education, a digital library, state-of-the-art learning and research facilities, as well as an integrated computer education management system. The creation of a good learning environment for both students and faculty has always been the top priority in MMU campus development. In 2003, the 42-acre second phase
development of the Cyberjaya Campus commenced to cater to MMU’s increased campus population and enhance its existing facilities.

The vision of MMU is to be a world-class university that leads in learning and research within the broad sphere of Multimedia and Information Technology. Its mission is to be an international centre of excellence for learning and research in Multimedia and Information Technology and to be a prime innovator of ideas, solution provider, and catalyst of change in the sphere of Multimedia and Information Technology. At this moment, MMU is in the process of receiving grants with the valuable support that has been extended by the University’s collaborative partners—NTT, Alcatel, Lucent Technologies, Siemens, Lotus, IBM, Sun, Ericsson, Intel, Motorola, Fujitsu, Nokia, Altera, and several foreign embassies such as Japan, the United States, Germany, France, and funding agencies namely Japan International Cooperation Agency (JICA) and Malaysian-American Commission on Educational Exchange (MACEE).

The Malaysian Government and MMU are committed to be a world leader in new wave pedagogy in science, mathematics, and technology education. MMU not only retains a techno-organic concept that underlines a pedagogic and inquisitive approach conducive for learning and experimentation. It has already taken a challenge for the 21st century by running a paperless administration. It won the best library web site award of the Malaysian Library Website Competition in 2005 (MMU, 2005). It is also the first university to offer E-scroll—a completely electronic transcript.

MMU Melaka campus houses the Centre for Foundation Studies and Extension Education and three faculties: Faculty of Engineering and Technology (FET), Faculty of Information Science and Technology (FIST), and Faculty of Business and Law (FBL). The Cyberjaya campus has four faculties, Faculty of Engineering (FOE), Faculty of Information Technology (FIT), Faculty of Management (FOM), and Faculty of Creative Multimedia (FCM).

As one of the major academic units in the university, the engineering faculties are committed to producing high quality engineering graduates to fulfill the technological demands of the Information Age. Both indepth and broad-based training on the fundamental principles, advanced technology, and practical aspects of engineering knowledge in the fields of telecommunications, computer, electronics, robotics, bioinstrumentation, electrical,
microwave, optical, mechanical engineering, and multimedia technologies are provided to students. For research and development, FET has ten Centers of Excellence, namely the Centre for Image Processing and Telemedicine, the Center for Robotics and Automation, the Center for Thermo-Fluids and Energy, the Center for CAD and Knowledge-Manufacturing, the Center for Applied Electromagnetics, the Center for Cryptography and Information Security, the Center for Electric Energy and Automation, the Center for Multimedia Communication, the Center for Photonics Research, Innovation and Application, and the Center for Microelectronics and Material Systems. These centers are set up for information sharing among different expertise interest groups and for collaborative usage among faculty members in their research fields. They use “e-mail” to provide information regarding monthly meetings along with research updates and the “Online Progress Monitoring Report” to keep the records of individual research activities. The centers also use “videoconference” service between the two campuses for seminars and lectures.

Malaysia is a developing country with an articulated vision of itself being a country, which aims to become fully developed economically, politically, socially, and spiritually by the year 2020. Vision 2020 acknowledges the goals that comprise Malaysia’s response to nine key challenges expressed by the distinguished former Prime Minister, Datuk Seri Dr. Mahathir Mohamad to convert her into a peaceful, stable, progressive, and multi-ethnic country. The Multimedia Super Corridor (MSC; http://www.mdc.com.my/msc/msc.asp) is Malaysia’s most exciting initiative for the global information and communication technology (ICT) industry. Conceptualized in 1996, the MSC has since grown into a thriving dynamic ICT hub, hosting more than 900 multinationals, foreign-owned and home-grown Malaysian companies focused on multimedia and communications products, solutions, services, and research and development. FIST and FIT play a vital role in producing IT competent personnel to serve the new and fast growing knowledge-based industry in addition to the manufacturing, business, and financial sectors. It is designed to serve the Multimedia Super Corridor (MSC) and the wider community for Malaysia to achieve its Vision 2020. The faculties provided IT courses such as Information Systems Engineering, Software Engineering, Business Information Systems, Information Technology Management, Data Communications, Artificial Intelligence, Security Technology, Knowledge Engineering, Multimedia Technology Management, Multimedia Systems, Software Engineering and Games Design, and Software and Animation. The Centre of Artificial
Intelligence and Intelligent Computing, the Center for Multimedia Computing and the Center of Network Computing are the centers for research and development in the fields of Information Technology.

Faculty of Creative Multimedia (http://www.mmu.edu.my/~mmcampus/about_info.html) integrates academic study with extensive creative digital technology production work. This proven approach has placed MMU at the forefront of Malaysian creative multimedia education. The faculty is made up of a well-balanced team of academicians and industry professionals in arts, architecture, broadcasting, computing, design, animation, and advertising. Specialized courses such as Digital Media, Film and Animation, Media Innovation, Interface Design, and Virtual Reality gives the students precise knowledge in the area of Media Science.

Business and Law are indispensable components in the successful management of companies in the public and private sectors. Management has always been of vital importance for any developing society. Without good management, resources would be wasted. Management has become even more important in a time of great changes, more complexity and global interdependence. Faculty of Business and Law (FBL) provides Bachelor of Business Administration (BBA) courses such as Banking and Finance, Marketing Management, International Business, Entrepreneurship, Human Resource, International Economics, Knowledge Management, and Bachelor of Law. Faculty of Management (FOM) provides similar BBA related courses having a few more majors such as Marketing with Multimedia, Management with Multimedia, Finance with Multimedia, Financial Engineering, Accounting, Media Innovation and Management, Innovation and Entrepreneurship, Electronic Commerce, Knowledge Economics, and Analytical Economics. All the faculties have courses for the postgraduate level including degrees in research.

The Center of Research and Postgraduate Programs is an important center of MMU towards establishing a World Class University dedicated to research and to advanced research in the broad sphere of multimedia. The center not only provides courses for postgraduate but also aims to support faculty members to innovate and create new technologies, products, and processes, and promote strategic cooperation through joint ventures between institutions and industries with linkages locally, regionally, and globally. All the research and development centers (Centers of Excellence) fall under this center. Currently the Melaka campus has two academic centers: the Centre
for Affiliate and Diploma Program and the Institute of International Languages. There are also two academic centers on the Cyberjaya campus: the Institute of Modern Languages and Communications and the Internet-Based Degree Program.

Other than academic and research centers, MMU has the various administrative departments to maintain administrative activities. These departments are the Business Development Unit, the Chancellery and Corporate Communications Unit, the Center for Commercialization and Technopreneur Development, the Center of Multimedia Education and Application Development, the Center of Research Postgraduate Programs, the Examination and Records Unit, the Finance Division, the Facilities Management Division, the Government Relations Unit, Human Resources, the Internalization and Intuitional Collaboration Unit, the International Student Services Unit, the MSC Relation, and On-campus Business Unit.

TOWARDS A PAPERLESS ENVIRONMENT

The technology is available today to provide information and data in a paperless environment. The paperless system can be viewed as a knowledge representation activity in which analysts implement and maintain a qualitative model of a software application that provides some desired functionality. In a traditional setting, this application model is described in text and diagrams, and the model’s realization is encoded in an imperative language that favors performance over flexibility (Blum, 1989). The presentation of data must support a system that is user-friendly, flexible, comprehensive, and quickly accessed (Breaux, 1994). Media in education has shaped our concept of knowledge throughout history. Today’s new technologies, which have been dubbed the knowledge media, are engaging from the convergence of computing, telecommunications, and the learning science. These new technologies play a role to renew a university from traditional to paperless by giving knowledge its new shape. Figure 1 shows the evolution of educational technology.
Since the Egyptians first used rudimentary writing utensils to communicate on sheets made from reed, paper has been the most common method of documenting information. This method of transmitting the written word has been so etched into the minds of today’s society that giving up this means of communication is not easy. In fact, studies have even shown that people are able to retain 30% more information if it is shown to them on paper than if they see it on a computer screen (Mathieu & Capozzoli, 2002). Paperless working is about alleviating the amount of times one physically handles documents and maximising the efficiency of the work by being able to retrieve information electronically and at the time that one needs it. Paperless applications are being used to enhance and simplify every area of business and the administration of employee benefits. Web sites and intranets have been designed to achieve paperless benefits to the full extent. Internet-based various products that harness the power of the online system, enabling small and mid-size companies to streamline communications, comply electronically with pertinent legislation, and provide employees accurate, easy-to-access, real-time information.

MMU currently runs a paperless environment through web-based applications, such as electronic books, e-learning campus, digital library, computer-based learning systems, database management system, videoconferencing technologies, distance learning, and smart card applications with multimedia
enabled features. Different Faculties are administering undergraduate courses introducing various worthwhile, prolific programs. Applications are also online based where everyone can apply through Internet during the application time.

E-Learning

E-learning is the kind of learning, which is facilitated and supported using information and communications technology through computers, software, Internet, local area network, audio video systems, and even satellites. E-learning can cover a spectrum of activities from supported learning, to blended learning (the combination of traditional and e-learning practices), to learning that is entirely online. In many cases, however, IT supported education has so far focused most on porting existing courses with traditional teaching methods onto the Web, just making nonindividualized teaching even more widely available. The semantic web has potential regarding the creation of more intelligent e-learning applications, providing individualization without a prohibitive increase in manpower. The “E-Learning Campus” is basically a virtual university where students go online instead of to specific lecture halls/classes. By just being online, students would be able to access web-based courses developed using innovative strategies (interactive graphical user interface, multimedia based learning techniques, speech technology, etc.) and delivered by way of modern internet-based technologies.

To be able to reach the paperless e-learning system, the approach should start from traditional techniques. A traditional learning system can move towards the e-learning system by following the steps in Figure 2. A virtual university calls for a new paradigm of higher education, as not only students, but professors, administrators, and staffs who are directly involved in higher education have to partake in the new institutional practice, which refines their roles and the mission of institutions (Rossman, 1993). The two major challenges that the virtual university faces are the provision of necessary resources to students, faculty, and administrators, and the recognition of degrees conferred. In this sense, existing higher education institutions have a better position in securing necessary resources and marketing their degree programs. The term, virtual university, has been overused without paying due attention to its meaning. Many have used the term referring to online courses (courses offered through the Internet at a distance) and others have
used the term referring to online course catalogs (electronic databases of online courses). Here, the term, virtual university, is defined to be the infrastructure for providing students with a learning experience and related support services to complete a degree program partially or totally online and providing faculty members with resources for teaching and doing research effectively online (Aoki & Pogroszewski, 1998). The e-learning system and the virtual university can be the key to open the gate to enter into the paperless learning environment.

Figure 2. Steps from traditional learning to e-learning
Universities and learning institutions around the world have recently felt the importance of an e-learning system, thus a lot of universities have made attempts to turn their campus paperless through an e-learning system. In 1989, UOP expanded its course offerings to an online format to enable adults to take courses anytime, anywhere. For online courses the instructor posts lectures online every week, and class participants use asynchronous threaded discussion and e-mail as primary communication modes to complete assignments and give feedback. UOP faces several challenges in supporting faculty, students, and staff use of its e-learning system. It provides training for faculty and students and has also created a highly robust infrastructure for their e-learning system. Course textbooks can be purchased online through its virtual bookstore. The core of the WGU administrative and academic service provision lies in its “Smart Catalog & trade”; an online catalog, which is designed to help students find the courses, programs, and other learning opportunities through sophisticated online searches. The “Smart Catalog & trade” is more than just an online catalog of courses. Through the “Smart Catalog & trade”; students can apply, enroll, review their records, apply for financial aid, work with their advisor, interact with other students, go to the library, purchase books, and contact WGU personnel. In other words, the “Smart Catalog & trade”; is the virtual campus itself where most critical information for students’ academic life can be found and most necessary transactions can be made (WGA Virtual University Design Team, 1996). In Japan, the emphasis has been on the use of a satellite-based learning system. Many universities, including NTT (the largest telecommunication provider) have an extensive satellite-based learning system. NTT has also developed a web-based e-learning tutorial environment for its employees. Recently Japan has initiated the Asian E-Learning Network (AEN) that will promote e-learning activities in Asia and look into standards in e-learning. In Korea, the Ministry of Education set up a comprehensive six-year (1997-2002) plan for the establishment and use of Information and Communication Technologies (ICT) in education. Under this plan, all schools are linked to the Internet. Singapore Virtual Polytechnic, together with SingTel, plans to start a service to deliver courses to the home using the Singapore ONE (http://www.ida.gov.sg/idaweb/broadband/infopage.jsp?infopagecategory=factsheet:broadband&infopageid=I880&versionid=5, this url is no longer functional, nor is the article available anywhere else) high capacity broadband network. It is an online e-learning portal that offers accredited and nonaccredited technical and business courses. There is also an interactive learning forum where students can share their experiences. Hong Kong
University has taken steps to turn the university paperless based on their current facilities. Many teachers have started to resort to providing web-based delivery of their course materials over the Intranet. Much communication and discussion between teachers and students now occurs through e-mails and newsgroups. It is a new paradigm for the teaching and learning environment. The university intends to develop the techniques and expertise for the support of high-quality video broadcasting of online lectures and video-conferencing for distance learning (Nam, 1999).

MMU currently has an e-learning campus. E-learning Campus of MMU also aims to maintain the human touch of attentiveness found in classrooms thus enhancing the virtual university experience. MMU has developed its own e-learning engine called Multimedia Learning System (MMLS) in 1999. The university has wireless Internet access that allows the students to access the learning materials anywhere on the campus. Even the hostels are equipped with Internet access. Subsequently, students get easy access to online lecture notes at anytime at their own convenience. Besides MMLS, the e-learning system of MMU depends on the Online Systems, the Digital Library, and the Teleconference Lab. MMU is already using the Smart Card system, which not only assists the e-learning system but also moves the campus one step closer to the paperless campus. The following sections will discuss more about the e-learning system of MMU.

**Multimedia learning system.** E-Learning systems must rely on a suitable multimedia learning system to create an interactive environment for learners. Most of the mega universities (Indira Gandhi National Open University, University Terbuka, Korea National Open University, The Open University, University of South Africa, Anadolu University, etc.) already call themselves multimedia teaching systems. But most of their contents are CD-ROM based (Daniel, 1996). In this principle, anything that can be put in a CD-ROM can be downloaded to a personal computer over an appropriate connection from a distance server. The multimedia learning system can be enhanced using proper design structure concentrating on user-friendly interfaces along with its consistency and flexibility. The whole area of computers in education can be very daunting; at this stage it may be wise to clarify where computers are being used in education. Figure 3 shows how a computer system can be used for education towards the multimedia learning system.
Before e-learning systems can use multimedia resources or make them available to students, the system needs to store them in digital format so they can be accessed using computers. An indication of the effort required for each resource is shown in Table 2 (Monteith, 1998).

**Figure 3.** Computer in education towards the multimedia learning system

**Table 2**

<table>
<thead>
<tr>
<th>Multimedia resource</th>
<th>Effort to create</th>
<th>(✓ indicates ranking from 1 to 5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Word-processed documents</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Presentations</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Digital images</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Graphics and clip-art</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Web pages</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Digital audio</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Digital Video</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Simulations</td>
<td>✓</td>
<td>✓</td>
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Key:
- Simple technology, low effort
- Complex technology, high effort
Underlying the concept of “a virtual teacher within a virtual classroom,” Multimedia Learning System (MMLS) was developed at MMU not only to suit the e-learning system, but also to focus on the needs of the entire educational enterprise. It is an intelligent management system, which serves as a platform for the delivery of multimedia rich contents to its learners. Within the technological framework, MMLS is designed as an intelligent, interactive, self-paced, instructor-led, web-based teaching and learning tool. The system is user friendly, platform and database independent, maintaining auto-administration. Furthermore, it is a fully web-based intelligent learner tracking system along with an instructor-led course management. Key features of MMLS are course management by an instructor, intelligent delivery system, questions bank, online self test, short notes, course outline, past year exam paper, lecturer notes, references, e-mail, chat, discussion board, online forum by course for asynchronous interactions, extensive student monitoring and tracking through Short Message Service (SMS) (Jaiballam & Asirvatham, 2005).

**Online system.** An interconnected network known as the Internet has been in existence for 25 years. Its growth began to accelerate when it linked up with public and commercial networks in the mid 1980s. Then a phase of explosive development began in 1993 when special software and better ways of connecting documents allowed users to travel in the network with picture, sound, and video. To establish and maintain any kind of e-learning campus and multimedia learning systems there is always the need of proper Information Technology service and network systems for the university. Through this interconnected network, online services (online system) provide instant access to information. It is a system where sets of interrelated components collect, manipulate, and disseminate data and information, and provide a feedback mechanism to meet an objective (Stair & Reynolds, 2001). MMU has a networked service, which is preserved by the Center for Information Technology Services (CITS). CITS is committed to the exploitation of emerging and cutting edge technology with a constant eye on the evolution of future technologies. It provides computing and communications infrastructure, media services, and support for the University’s instructional, research, and administrative programs. CITS concentrates on three main services, (a) Systems Operations and Networking, (b) Audio-Visual Support Services, and (c) Computer Support Services. A Local Area Network (LAN) has been established inside MMU. Wireless networking is also available at certain areas for portable devices. CITS is responsible for maintaining the network system of MMU. With the LAN-based support
system, PCs, workstations, or terminals are tied into a client server, which has access to internal and external Database Management System (DBMS) or hard disk units and/or CDROM read-only units. Normally, digital data provided on magnetic tape is retrieved and stored as either files on hard disk units or records in a DBMS. This kind of facility and service by CITS not only maintains the network architecture but also provides various online systems to assist students as well as staffs to be able to make the proper use of a paperless environment. Based in the networking system, MMU has its own online system. This article will discuss the online system at MMU after reviewing the online system of a few other universities.

To make use of the Internet, in 1995, UK Open University (UKOU) equipped the homes of the elected executive committee members and student associations with suitable equipment so that they could use e-mail in conducting the business of the association (Daniel, 1996). A year later they judged that the advantages it offered outweighed the difficulties, mostly of reliability. Assuming that the delivery of e-mail will become reliable, the UKOU is developing techniques that will make tutors comment through this medium as useful as possible to students and allow the university to monitor the process and capture the marks awarded. WGU students can interact with other students through a virtual student union. There are two features in the student union: “Café” and “discussion groups.” “Café” is a place where a student can interact with other students in real time through a chat room capability, while a discussion group is a place for a student to talk online about common issues and concerns asynchronously. In addition, the student union is used to post news or announcement about WGU, its course and program offerings, services, and special events (Sparks, 1996).

The “MMU Online System” is a web-based facility for students and staff to perform the following activities:

- Profile view/update
- Add/drop course
- Exam slip
- Result slip
- Timetable
The online bulletin is used to make all necessary announcements from the administration. Using the Online System, students can register courses, withdraw courses, print examination slips and view academic results. The students’ information center allows students to edit personal profiles, check financial status, view academic timetables, and submit activity proposals. Staff can also change their personal profile and book venues for classes. Both students and staff have the web mail service and the online postal service gives the ability to check their incoming letters/parcels. The staff/students directory keeps the record of all current staff/students. Students can also evaluate lecturers through the online process and the lecturers can view their evaluations. Each student/staff of MMU is given an Integrated Computerized Education Management System (ICEMS) password. The ICEMS password is necessary for online course registration, viewing results online, accessing the financial information kiosk, and accessing the academic evaluation system and all other online system facilities. Figure 4 summarizes the “MMU Online Systems.” Very recently “MMU Online Systems” has included a new feature that keeps records of class attendance, which are uploaded by lecture for the students to monitor their attendance status.
Another interesting kind of service focusing on the paperless system is the MMU SMS Service and Info line. MMU is also providing SMS services to the MMU community. The purpose of providing these services is to allow students and the MMU community an effective means of getting information from MMU at their fingertips, such as:

- MMU administrative directory
- MMU faculty directory
- Examination results retrieval
- Notification of class schedules
- Registered course detail
- Application status

This project is a joint effort between the Center for Commercialization and Technopreneur Development (CCTD), and CITS. Some of the important services are examination result retrieval, notification of class schedules, registered course details, and application status. MMU Info Line is an Interactive Voice Response (IVR) System developed fully by the Center for Multimedia Education and Applications Development (CMED), aimed at
providing information about MMU by way of a telephone within seconds. The system is activated 24 hours a day for the convenience of MMU students, staff, and the public. This auto-telephone-operator system takes care of general inquiries by the public. It offers different options to the callers including call transfers, obtaining information on the courses offered, and examination results (http://mmu-search.mmu.edu.my/websearch.php?query=Telephone+system).

**Tele-conference.** E-learning or distance education often requires videoconferencing or teleconferencing. Videoconferencing or teleconferencing is the ability of two or more distant groups to communicate face to face in real time by using a combination of audio and/or video equipment. In a typical videoconferencing lab, the instructor’s workstation contains the controls for the teleconferencing equipment and also has the peripheral equipment that is placed in the room (Hircko, 2003). The rapid improvement of telecommunications in the last two decades has been helpful to both types of distance education such as correspondence study and remote-classroom teaching. France was the first country to introduce popular computer mediated communications in the late 1970s. It replaced the traditional telephone directories with a database that subscribers could search from home using a simple terminal. Countries like the UK, began to use telecommunications intensively only during 1990s (Daniel, 1996). In addition to its use for one-to-one communication the telephone is now used regularly in conference mode to link students in tutorial groups. Such audio teleconference tutorials have been commonplace in Canada for years. Only in the last decade UKOU made systematic use of this technology, notably for its more dispersed students in Wales and Scotland. Television broadcasting is not a new medium. However, the number of channels available for delivering television is rising rapidly and all the mega-universities now want to expand their TV and/or radio broadcasting. The Korean mega-university now has its own cable TV channel. The UKOU became part of BBC’s new all-night educational programming in 1995 and the Center National d’Enseignement Distance (CNED) is involved with France’s new educational TV channel.

The Networked Multimedia Education System Project (NMES) lab in MMU is a teleconferencing system but not a broadcasting channel. The NMES is a collaborative project between the Ministry of Energy, Communication and Multimedia (MECM) and the Japan International Cooperation Agency (JICA) with the aim of setting up a satellite-based tele-education infrastructure and applications in Malaysia, focusing on IT and multimedia training.
and education. The NMES system allows a two way interactive lecture model to be transmitted from the hub site to the five remote sites. The hub site is located at Multimedia University, Cyberjaya, and the remote sites are: (a) Multimedia University, Malacca campus, (b) Penang Skills Development Centre (PSDC), Penang, (c) Institut Latihan Perindustrian (ILP), Kuantan, (d) Telekom Training College, Sabah, and (e) University Malaysia Sarawak. Students' at all remote sites can see and hear the lecture being transmitted from the hub and they can provide feedback by asking questions or by using the chat function. This real time interactive project is similar to a face-to-face class where the only difference is that the lecturer is located hundreds of miles away from the students at the remote sites. Besides transmitting lectures for these courses, the system is also used for the transmission of seminars, short courses, as well as meetings by way of the videoconference system with the remote site. Even though Malaysia is a developing country, MMU has established a teleconferencing system using the latest technologies such as satellite communications; high speed networking infrastructures, and plasma screens with powerful audio/video systems (http://www.mmu.edu.my/~crpp/nmes/index.html).

**Digital library.** An apposite learning system will always have to depend on learning resources and materials such as a library. If learning systems were paperless and digital, a library could contribute a lot to the perspective matters. For example, the goal of the “Stanford Digital Library” project is to provide an infrastructure that affords interoperability among heterogeneous, autonomous digital library services. These services include both search services and remotely usable information processing facilities (Baldonado, Chang, Gravano, & Paepcke, 1997). Harnessing technology and innovation, and leveraging the intellectual and cultural resources of the University of California (UC), the California Digital Library (CDL; http://www.cdlib.org/glance/overview.html) supports the assembly and creative use of the world’s scholarship and knowledge for the UC libraries and the communities they serve. Perpustakaan Sultanah Zanariah (PSZ; http://web.utm.my/psz/index.php?option=content&task=view&id=15&Itemid=46&limit=1&limitstart=1) is a library in Malaysia, which occupies the central location at the Universiti Teknologi Malaysia (UTM) main campus. This library offers information through a wide range of international CD-ROM databases in the fields of science, technology, and the social sciences. Besides these, users may also search local databases.
The MMU Library was established to be an effective focal point of documents and information supply in digital formats, worldwide library services, and international library cooperation. Induction courses on the use of the services and resources are provided and the courses on information skills, including the use of various databases and online resources are given. Besides, a comprehensive array of online guides and web pages that describe services and resources in detail are also provided. The library aims to provide easy and swift access to the materials needed by the students. The library presents a wide range of resources in printed and nonprinted format to enable students’ access to a vast collection of information, resources, and learning materials. These include books, periodicals, newspapers, sound and video recordings, special collections, reference collections, and an expanding range of electronic resources such as CD-ROMs, computerized bibliographic databases, electronic journals, internet resources, and online information. The library also offers a wide range of services, both online and traditional, satisfying the information needs of the students, including loan services, electronic information services, user education, reference services, interlibrary loan services, and document delivery services. The online library catalogue, namely GEOWEB, enables students to search for library collections. It is easy to use and has many self-service features including loan renewals, reservation of items on loan to other users, and checking items on loan. This service is available across the campus and worldwide. Besides the online catalogue, the library also provides a number of terminals to allow students to search and navigate the borderless world of information. Various online databases are also available in the library and these databases are accessible through the library’s homepage. The library also provides links and the latest periodicals from the web-based resources to enable students to keep abreast of the latest developments in the world (http://vlib.mmu.edu.my/2005/aboutlib.php).

Smart Identity Card

Any institution must provide its students/staff with an identity number along with an identity card. When this identity card behaves smartly, providing paperless features, it is called a “Smart Card.” The smart card is another step forward towards a cashless and paperless environment. A tiny computer microprocessor has been embedded into a plastic card, similar to credit cards and is programmed to perform various financial and nonfinancial
applications. The smart card is expected to have a profound effect on the operations, work practices, customer services, and financial systems of an organization. The objective of the smart card is to improve the operational aspects of an organization. A single card holds various types of information in electronic form with sophisticated security mechanisms built into it. Roland Moreno developed the first smart card in 1974 (http://java.sun.com/products/javacard/smartcards.html). Smart cards are much more popular in Europe than in the United States. In Europe, the health insurance and banking industries use smart cards extensively. Every German citizen has a smart card for health insurance. Even though smart cards have been around in their modern form for at least a decade, they are just starting to take off in the United States (http://electronics.howstuffworks.com/question332.htm). In Hong Kong University, their current smart card already provides a VISA-cash function for their staff and students. Unfortunately, it is not yet a well-accepted means of payment. Commercial arrangement with banks should be secured to make possible the use of the smart card for small cash payments, such as photocopying, laser-printing, and small-value items over the counter, as well as other types of larger fee payment through one’s bank account (WGA Virtual University Design Team, 1996). The world’s first national smart card scheme to store biometric data on an in-built computer chip has been introduced in Malaysia. The cards are compulsory for Malaysia’s citizens and are encoded with a copy of the owner’s fingerprints (http://www.altium.com/Successes/SwinburneUniversity/).

MMU is one of the pioneer institutions to implement the multi-purpose smart card in this region. Currently MMU has more than 20 financial and nonfinancial applications running in both the campuses that require the use of the smart card. For the first time in history, MMU has introduced the use of smart card for their convocation process. A student needs to flash his or her smart card onto a smartcard reader and the system will retrieve the name and announces it during the convocation. The student’s name, major, and photograph will also be retrieved and displayed on the screen. The objective of this system is to ensure a smooth and error free convocation process.

The smart card makes a significant contribution to the paperless environment. It carries all necessary information about a student/staff, which can be retrieved by the computer systems without any kind of physical documentation. The smart card can be used as an electronic payment system. The smart card used at MMU is at the same time an identity card, a bankcard, and an electronic cash holder for electronic payment systems. Food courts and
shops inside MMU already have such an electronic payment system so that students/staff can purchase things with only the help of the smart card. Furthermore, the smart card is used for the digital library to borrow and return books. The library computer system will generate all kinds of report regarding borrow/return using the online system after successful verification is completed using the smart card.

**DISCUSSION**

Although MMU is a newly established university in Malaysia, it supersedes some other prominent universities with educational systems, e-management structures, and digitization of paper-based works. In a very short span of time, MMU approaches the proliferation of digital learning systems, e-governance throughout the twin campuses, and the maximum implementation of multimedia-based features in the school system. The paperless environment prevailing at MMU carries paramount importance in paving the way toward a digital education system as a challenge for the 21st century. The study shows that other renowned universities have taken reasonable and efficient measures to meet the challenge of the 21st century, but MMU has achieved almost all in the sphere of a paperless digital education system. However, some drawbacks still exist as a part of any big system. The implementation process is not yet achieved to the full extent possible, and the low bandwidth of the whole network sometimes encumbers propagation flow of data resulting in server breakdowns for the entire system. The infrastructure of optical fiber communication on the campus is in need of being maintained with the utmost care to sustain the flow of bandwidth in full swing.

The study also shows that, the locally controlled centers of WGU have not been implemented yet, demonstrating the difficulties of physical arrangement of a virtual university. On the other hand, as a large number of UOP students are still taking courses at one of their local campuses, the infrastructure for its virtual campus is not as extensive as that of WGU. There is no online registration system yet, and a student has to contact a University Enrollment Counselor to register. To apply for financial aid, a student has to visit one of the UOP campuses. Though still limited, UOP is rapidly adding its online administrative functions and now students can view their demographic and academic information and request transcripts online. In the near
future, UOP claims that it will provide such online information services as admission and matriculation statuses, transfer credit status, degree program summary, updated address and phone numbers, e-mail messages to communicate with staff, and obtain course modules/descriptions. On the other hand, many paper forms exist throughout Hong Kong University. Staff and students have to fill in all kinds of forms daily, and dispatched the forms by internal mail or personal delivery to the various offices for processing. With the increasing use of the Web, many offices have already resorted to storage of the forms on the intranet so that users can print out the forms themselves, thus reducing the need to ask for the delivery of a form. Even the mega universities need a lot of enhancements in their multimedia learning systems to fully enjoy the fruits of an e-leaning system and a paperless environment.

This article illustrates that e-leaning is the most acceptable way to reach a paperless learning system. The learning system that can provide the correct e-learning system will not only make the learning system paperless, but will also support the distance learners to a great extent. MMU has already successfully adopted the e-learning system by following all the necessary steps. The “online system,” “multimedia learning system,” NEMS, and the “digital library” have flourished in the e-learning system at MMU to reach the paperless system. The study clearly shows that MMU has fulfilled almost all the criteria to become a paperless environment compared to the other universities mentioned in this article. The article points out that MMU intends to take the challenge for the 21st century to establish the e-learning environment along with e-governance. MMU has already taken the challenge to become a paperless university through the e-learning system. The “online system” at MMU not only makes the learning system paperless, but also makes its management system paperless. Finally, the “smart card” system gives the final touch to the paperless campus. The use of the “smart card” not only reduces the use of physical documents, but also reduces the use of cash.

CONCLUSION

The world is now at the start of the 21st century following the Knowledge-era where every aspect of human life will be enriched beyond imagination. Knowledge is fast becoming a powerful engine in human lives and thus we should be alert to availing ourselves of any opportunity to boost our
knowledge. MMU is persistently approaching new and innovative methods, besides radically changing the educational outlook to become an internationally prominent institution that is absolutely technology based in the shortest span of time. MMU, fully equipped with state-of-the-art instructional facilities, extensively uses e-management on both campuses along with the usage of ICEMS to promote a paperless-administration environment and spread information electronically among the campuses. To mitigate the gap of the digital divide, MMU has administered the latest internally developed teaching technique called the MMLS to deliver the curriculum as well as online systems for an exhilarating, worthwhile, and extraordinary lifelong learning experiences leading towards the paperless environment. But the University should plan for continuous improvement of the computer provisions to staff as well as students, install nonstop servers and networks, and provide more speedy access to the intranet and Internet with the optical fiber backbone. The reengineering of its administrative processes and office procedures, the recognition of digital signatures, which requires authentication, the secure transmission of integral documents, and the provision of complete audit trails for data recovery are a few of the critical developments that will facilitate the achievement of the perfect vision. Further, the potential e-learning system should pay attention to the needs of disabled students and give proper guidance to the institutional attitudes that may promote the accessibility of online courses with their full participation. If all these areas can be fulfilled, then we can make the best use of a paperless environment.

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