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Document Version:
Final Published version, also known as Publisher's PDF, Publisher's Final version or Version of Record

Publication record in CityU Scholars:
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8th International Congress of Information and Communication Technology, ICICT 2019

Modernizing I.T. Applications for Self-Financing Higher Education Institutes: a Make-To-Order Methodology with Broad Relevance

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Abstract

This invited paper presents the research work on a Web-based development infrastructure which is based on Microsoft's latest development tools, for the core functions of higher education institutes covering eLearning drop box system, assignment submission marking, examination board reporting etc. After 15 months of development experience with user try out and suggestions, we postulate that the prototype systems produced can be translated into a Make-To-Order (MTO) methodology for rolling out applications that provide better student user experience, more efficient programme administrative operations and better service to teaching faculties via a web-based environment. The MTO methodology includes the Dell (Dell Technology Forum) proposed MAT approach which advocates the concept of Modernization, Automation, and Transformation (MAT).

Keywords: Make-To-Order methodology; Dell's MAT approach; Web application for education; Mobilizing your business.

1. Introduction

1.1 Core applications of self-financing higher educational institutes

As at 2018 there are about 20 self-financing (Self-financing) higher education institutes (Table 1) in Hong Kong. Due to the self-financing nature, many of these institutes use open source learning platforms, open source programming language, and open source database management software tools for their core applications.

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Table 1. Self-financing higher education institutes in Hong Kong, October 2018 (partial list).

Name of institution (Chinese name in parentheses)	Type	Year established	Year granted university status	Legal regulations for the institution
Caritas Institute of Higher Education (明愛專上學院)	Private	1985 - Established as Caritas Francis Hsu College (明愛徐誠斌書院), registered as an Approved Post Secondary College in 2001 2011 - The new Chinese name "明愛徐誠斌學院" was adopted. Then, the college change its name to the current one in same year	Not applicable	Post Secondary Colleges Ordinance (Cap.320)
Centennial College 明德學院	Private	2011	Not applicable	Post Secondary Colleges Ordinance (Cap.320)
Chu Hai College of Higher Education (珠海學院[1])	Private	1947 - Chu Hai University in Guangzhou 1949 - Chu Hai College, re-established in Hong Kong 2004 - Chu Hai College of Higher Education, registered as an Approved Post Secondary College in same year	Not applicable	Post Secondary Colleges Ordinance (Cap.320)
Gratia Christian College (宏恩基督教學院)	Private	2015	Not applicable	Post Secondary Colleges Ordinance (Cap.320)
Hang Seng Management College (恒生管理學院)	Private	2010	Not applicable	Post Secondary Colleges Ordinance (Cap.320)
HKCT Institute of Higher Education (港專學院)	Private	2014	Not applicable	Post Secondary Colleges Ordinance (Cap.320)
Hong Kong Nang Yan College of Higher Education (香港能仁專上學院)	Private	1969 - Hong Kong Buddhist College 2014 - Hong Kong Nang Yan College of Higher Education, registered as an Approved Post Secondary College in same year	Not applicable	Post Secondary Colleges Ordinance (Cap.320)
Hong Kong Shue Yan University (香港樹仁大學)	Private	1971 - Hong Kong Shue Yan College, registered as an Approved Post Secondary College in 1976	2006	Post Secondary Colleges Ordinance (Cap.320)
The Open University of Hong Kong (香港公開大學)	Public[1]	1989 - The Open Learning Institute of Hong Kong	1997	The Open University of Hong Kong Ordinance (Cap. 1145)
Technological and Higher Education Institute of Hong Kong (香港高等科技教育學院)	Public	2012	Not applicable	Operated by the Vocational Training Council under the Vocational Training Council Ordinance (Cap. 1130)

1.2 The school of continuing and professional education (SCO)

SCO, starting as an extension section of City University, has been running programmes in Hong Kong for the last 2 decades, serving part-time diploma level programmes, then full time programmes and later self-financing degree programmes. As of 2018 SCO runs partnership programmes with UK universities and local government supported programmes, including 3-year Full degree programmes with UK universities, Diploma level programmes like the one year part-time Professional Diploma in Occupational and Safety and Health (PDOSH) programme (SCO). SCO has different departments covering Commerce, Language, Social Science, Science and Technology), supported by local teaching faculties, Programme officers, plus clerical support. From the I.T. perspective, SCO has, like other institutes, CORE systems covering student recruitment, student examination score, student GPA calculation etc. These are worked on by different I.T. development staff using primarily Windows operating system with programming languages like Java, C, Visual Basic, Visual C# etc. Due to the good development culture of the last decade, the development staff went on well with users who concern about the functionality while the development staff concerns database design, programming, user support etc.

In July 2017 a research task called New Platform drop box systems was proposed for development for use as eLearning platforms for Diploma level programmes. The research and development work provided good technical experience and inspirations through trying out the latest Microsoft based development tool, database tool, and the Windows 10 server which were then integrated into a efficient and easy-to-maintain system infrastructure. 11 core education prototype systems were created ranging from mobile apply, to examination board reporting.

Section 2 of this paper describes the MTO infrastructure while Section 3 describes the drop box systems for the 7 modules of PDOSH. Section 4 provides conclusion on this project highlighting a successful development strategy through the MTO infrastructure, also suggesting to I.T. development staff to either considering adopting the MTO infrastructure OR reviewing their application systems running on different database server, using different programming environment to share a central integrated database design infrastructure like the Euclidean Banner system (Euclidean) used by City University for their 4-year based undergraduate degree programmes.

2. Development

2.1 Make-To-Order (MTO) infrastructure for mobilizing the core applications of self-financing education institutes

The MTO infrastructure consists of a set of core application prototypes built around the latest Microsoft development tools. It covers mobile apply, eLearning drop box, programme announcement function, assignment submit function, assignment marking function, mobile attendance record, and examination board meeting functions (Fig. 2.1.) The tools include Visual Studio Community 2017 (for rapid application development with Visual C# programming), SQL Server 2014 database server (for integrated core function database design, SQL Management Studio 2014 (with a simple to use user-interface for designing and re-designing the database tables for various core functions (Fig.2.2.). The main objective of the infrastructure is to produce a unified mobile phone plus desktop computer interface for students, programme officers and teachers to communicate learning material, programme announcements, assignment submission and marking etc.

2.2 Prototype core education systems produced using the MTO infrastructure

The prototype core education systems (Fig. 2.2.) include mobile apply, to eLearning, to Assignment submission, marking, exam board meeting (1-11) through the MAT approach which stands for Modernization through our MTO infrastructure, Automation through latest Microsoft development tools and database management tools, and Transition of development process for I.T. staff through self-development and review of their application systems.
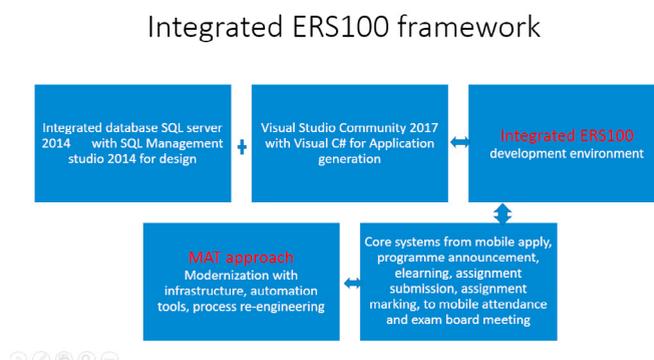
Integrated ERS100 framework

Fig. 2.1. MTO infrastructure for prototyping core education applications.

1. Mobile Apply (Quick apply)-complete within one day or two 17 Aug 2018
1b Programme Leader supply username and password to Applicant 17 Aug 2018
1c Programme Leader check completed Application Form 17 Aug 2018
2. download Application Form from Programme Drop Box 17 Aug 2018
3. upload Programme Application Form to Programme Leader Drop Box 17 Aug 2018
4. Programme Announcements, Orientation Programme etc. (Programme Officer Page) (db2)
5. Class starting Lecturer Upload Lecture Material (lecture1...) (db2)
6. Student eLearning (Weekly lectures) download Lecture Material (lecture 1...) (db2)
7. Submit Assignment (sgs)
8. Mark Assignment (sgs)
9. Mobile Attendance Record (sgs...)
10. Exam Board Meeting (sgs)
11. Clean up Drop Box   **Updated: 23 Aug 2018 Thu, Clean up Drop Box**

Fig. 2.2. 11 prototype core education systems produced using the MTO infrastructure.

3. Implementation

3.2 Testing the drop box systems interface to SCO (System 4 in Fig. 2.2.)

In end October 2018, a seamless connection to the programme with a desktop computer in SCO learning centre in Tsimshatsui East Kowloon received the following comments from a Part-time Lecturer (PTL), who said: "Looking at your system access, it is clear and easy to follow, and the speed is around 3 times faster than access to the Canvas

(Canvas) eLearning portal for my top-up degree course which requires a number of steps from logging to connection to the course (Fig. 3.).

Pending the recruitment of enough students for a new cohort, the drop box system for PDOSH programme can be implemented. The user interface shows that the MTO infrastructure provided can be used to provide addition of new systems (details of the prototype systems contained in Fig. 2.2.).
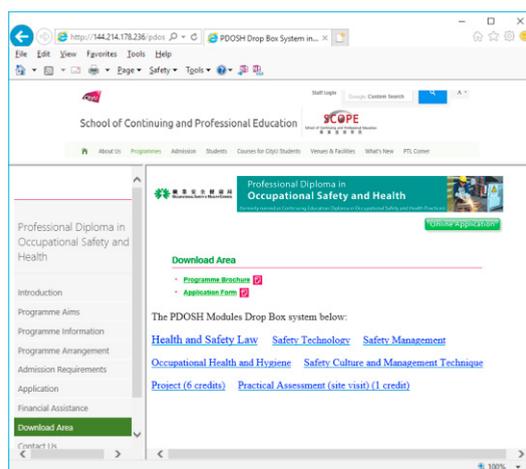

Fig. 3. Drop box system for the "Professional Diploma in Occupational Safety and Health" programme plugged in to SCO website.

3.3 From mobile apply to examination board meeting systems through the MTO infrastructure

Moving forward to 2019 onwards, the MTO infrastructure can be used to roll out other systems like mobile apply, assignment submission, assignment marking, examination board meeting etc. (Systems 1-11 in Fig. 2.2.). Prototype systems have been written and tested, ready for SCO to mobilize further the business in the I.T. transformation journey for web-based access by students, programme officers and teachers.

4. Conclusion and Discussion

4.1. Future usage of the MTO infrastructure by I.T. development staff

The MTO infrastructure has shown to be practical and efficient for developing systems which run on the Internet. Through the central database structure (Siu, Brian), the systems can share information without duplicate processing. It may take some time before users are familiar with our efficient and fast access web-based interface, appreciating the advantage of the central database design architecture where seamless management information could be extracted covering student grade point average (GPA) score, examination results, graduation status, etc. As shown by the speed of the our MTO infrastructure for systems development, we are positive that our web-based systems will provide fast and efficient access for different users. For current systems developed by different colleagues, it is up to them to participate in the MTO infrastructure, OR to adopt their programming language like Java, and C, however it is postulated that a central database architecture is needed, like the Euclidean Oracle Central database (Euclidean). I.T. development staff can choose to upgrade their system to share and integrate with the central database in the MTO infrastructure (Fig. 2.1.).

4.2. Staff self-development and training

I.T. development staff could make use of staff development funds from SCO for self-development, including attending up-market technology forum, taking Microsoft (Microsoft Official Course) web development training

courses, trying out the Visual Studio Community 2017 platform, subscribe to training sites like CodeProject (CodeProject), etc.; and creating similar applications in Fig. 2.2 for different programmes.

5. Acknowledgement

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