

Integrated Class Scheduling System for Selected State Universities and Colleges with Satellite Campuses in the Philippines

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Abstract— Today, higher education in the Philippines is made up of more than two thousand higher education institutions which include public and private colleges and universities. Most of those institutions have one or more local satellite campuses from different locations or regions, some even have international satellite campuses. This slowly is becoming a trend in education, where colleges and universities are expanding their reach to provide their clients a growing choice of locations. One of the main advantages of this system is that it resolves the problem of distance as one of the major barriers why students especially in far-flung areas sometimes lose their opportunity to earn a college degree. Through the effort of Commission on Higher Education, monitoring and accreditation are being implemented to ensure that those satellite campuses are subject to the same strict quality control as its parent school. Expensive academic resources such as the laboratory rooms as well as the expertise of some faculty members are usually being shared too. However, problems regarding sharing and consolidation of school resources usually arises between and among those parent and satellite campuses. One of which stems from the conflict in class schedules prepared by the school administrators every semester. Currently, most of those parent universities are manually collating the class schedules from their different satellite campuses. It's very important that class schedules be accurate and reliable for so many obvious reasons. Thus, this study aimed to develop a new system that will provide those colleges and universities with satellite campuses a new, easy and quick way of creating and generating room, class and individual faculty time-table and at the same time allows users to automatically detect and prevent conflicts upon the creation of schedule. The study used an appropriate development method for the system design and analysis. Then, the researchers chose the most suitable programming language and database that were utilized in the development of a reliable scheduling system intended for deployment via a suitable on-line access. The output was evaluated based on the ISO 9126 Software Quality Assurance Model.

Keywords— Information technology systems, class scheduling, integrated software, time-table, satellite campus, software model, higher education, online school system

INTRODUCTION

The world seems to be rapidly evolving towards modernization and continuously gearing up on becoming a technology-driven planet because of the changes information technology offers. IT infrastructures have already invaded various facets of our lives. They have become vital instruments in our activities [1]. More and more establishments, institutions and organizations both public and private, are instituting IT systems in their operations to achieve better speed, accuracy and efficiency in the quality of their works [2]. Obviously, the academe is one of the sectors that if would be granted the appropriate information systems could benefit most from the modernization brought about by the technology [3]. And an information system that would eliminate the tedious task of manual scheduling or time tabling of the availability of faculty, students and classrooms is one of the greatest contribution that the IT could impart in a school specially in larger universities where there are vast amount of resources [4].

The general area of scheduling has been the subject of intense research for a number of decade [5]. Scheduling and timetabling are typically viewed as two separate activities, with the term scheduling used as a generic term to cover specific types of problems in this area. Consequently, timetable construction can be considered as a special case of generic scheduling activity [6].

Class scheduling of universities is a large, complex, and time-consuming task [7]. Along the time line of each, classroom slots must be able to be allocated to instructors and their classes of different departments without violating any predefined rules or constraints.

Class Scheduling System is a software that improves and speeds up the process of room utilization and scheduling of classes by making it more accurate, efficient and suitable to everyone impacted by these processes [8]. The system has features that can provide a database for storing records and information. It allows the end-user to add, edit, delete, save and update records or information if

some changes occur. It can generate reports such as class schedule, faculty schedule, room schedule, instructors list, room list and section list.

Background of the Study

According to the National Statistics Office, Philippines with an estimated annual population growth rate of 1.9 % is one of the fastest growing countries in Asia in terms of population and still expected to continue its growth for the next few years [9]. These population increases will consequently demand access to higher education opportunities. As of Academic Year 2011-2012, Philippines has 2,299 public and private Higher Education Institutions (HEIs) including 110 state universities and colleges all over the country [10]. Most of these SUCs are strategically located in the urban areas of different regions. However, growth on the main campuses or parent campuses may soon jeopardize their ability to fulfill their function as a state College or University. Thus the construction of satellite campuses appears to be the answer. Currently, there are 437 satellite or external campuses in the Philippines scattered within or beyond the locality.

Satellite campuses definitely benefit the community. They target specific population areas normally underserved by main campuses. They allow more direct access to higher education for targeted populations. These branch campuses also serve as a benefit to the main campus. As students utilize services offered at branch campuses, congestion or overcrowding on the main campus decreases. This means an ease in parking situations as well as reduced traffic on campus roadways. Further, branch campuses reduce the commuting costs for faculty, staff and students. The closer the services, the less time spent on crowded roadways [11]. Finally, the more sites opened to students, the more students would be given the chance to pursue and finish a professional degree.

Problem Statement

Indeed there are so many advantages that could be brought by the expansion of main schools thru the construction of satellite campuses. However, constructing external campuses means decentralizing school resources e.g., pool of faculty members and laboratory rooms. Expensive laboratory rooms for specialization might be required to be shared among the other satellite campuses. Same thing, Professors handling specialized or major subjects might be required now to render his service both on the main campus and on external campuses. Further, this might also set off difficulties in consolidating the schedules of faculty members since they maybe given teaching loads either in the main campus or in any of its satellite sites, and all those teaching hours should be consolidated in a single file for the purpose of keeping daily time records and processing of payroll matters. The fact that class scheduling must be done every semester still added into the difficulties involved in the time-tabling task [12].

Given this scenario, the university should be equipped with an efficient scheduling scheme that would handle smooth time tabling of the above-mentioned resources, otherwise, students' schedules might be negatively affected as well [13]. Thus, the circumstance would entails the need for a computerized scheduling algorithm which covers all aspects of the activity of allocating resources such as instructors, lecture rooms and laboratory rooms to each class or section, at the same time, satisfying some predetermined academic rules or constraints and objectives of the school [14].

Indeed, the development of an application system which is capable of generating class schedules automatically would be of great help to universities and colleges in the Philippines with satellite campuses; however, there may be impediments to its realization, thus, this study specifically aimed to determine what are the different IT infrastructures required for the development of the system as well as the significant features that should be integrated into it to optimize the performance of its intended functions. Further, this study also wanted to verify the system's level of acceptability in terms of several software criteria.

SYSTEM DEVELOPMENT

This part presents the theoretical consideration in developing the system.

Conceptual Framework

Figure 1 presents the process of the system development. The study was presented using the three dimensions of conceptual paradigm: input, process and output.

The first stage includes the gathering of primary inputs for the Integrated Scheduling System in order to develop the application. System requirements were considered which basically include the infrastructures needed for the development. Other external resources were also considered.

The second frame is the Process stage. In this study, the researcher adopted the Systems Development Life Cycle (SDLC) Waterfall Model which is a conceptual model used in project management that describes the stages involved in an information system development project, from an initial feasibility study through maintenance of the completed application [15].

Lastly, for the Output stage, this is the developed system, the Integrated Scheduling System for Selected State Colleges and Universities with Satellite Campuses in the Philippines.

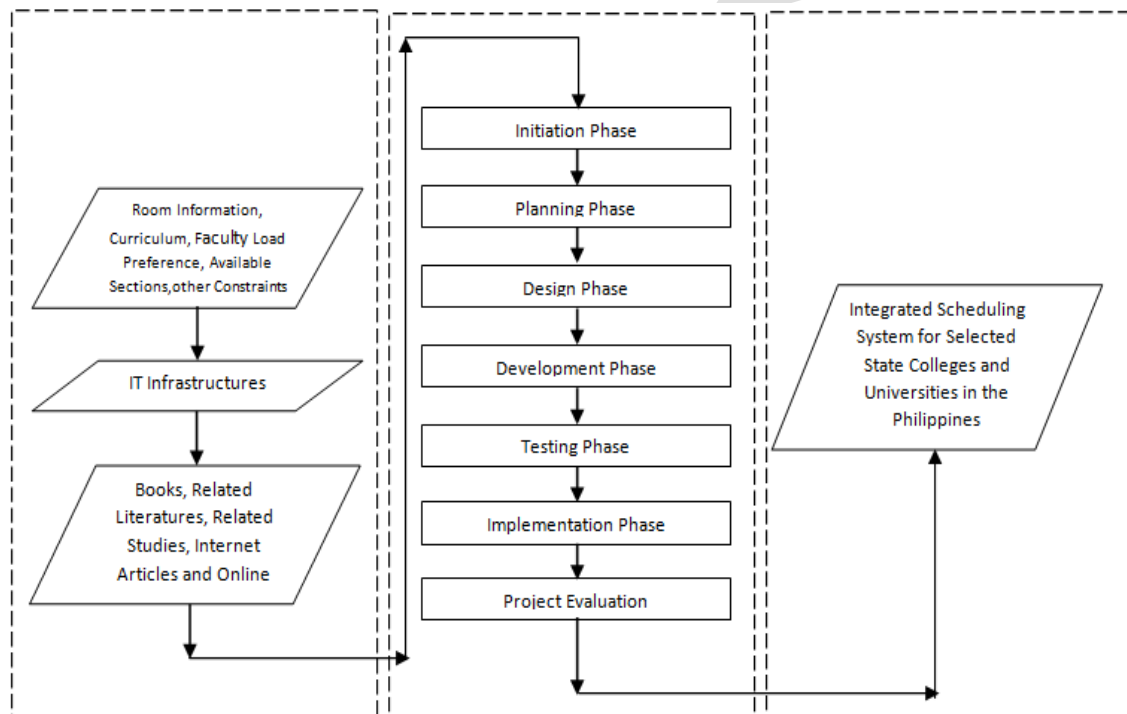


Figure 1. Conceptual Process of the System Development

Project Methodology

The researcher used the Unified Modeling Language (UML) in specifying, constructing and communicating the design of the system. Among the different UML diagrams, the researcher used the Use Case Diagram and Sequence Diagram. Figure 2 shows the functionality of the system. The system administrator is responsible for identification and classification of valid users according to their access level as well as for the maintenance of the whole system. The power user is in-charge for the implementation and management of all the important modules responsible for scheduling per se. Execution of all rules and constraints in designing schedules under the Class Builder Module is one of his major functions. Technically, the power user must be granted access to all system modules, thus he is also allowed to log in on the System Maintenance and User Access Details Module. Limited access was given too to some office staff who would be performing data entry. Lastly, faculty members are allowed to view their own schedule generated by the system.

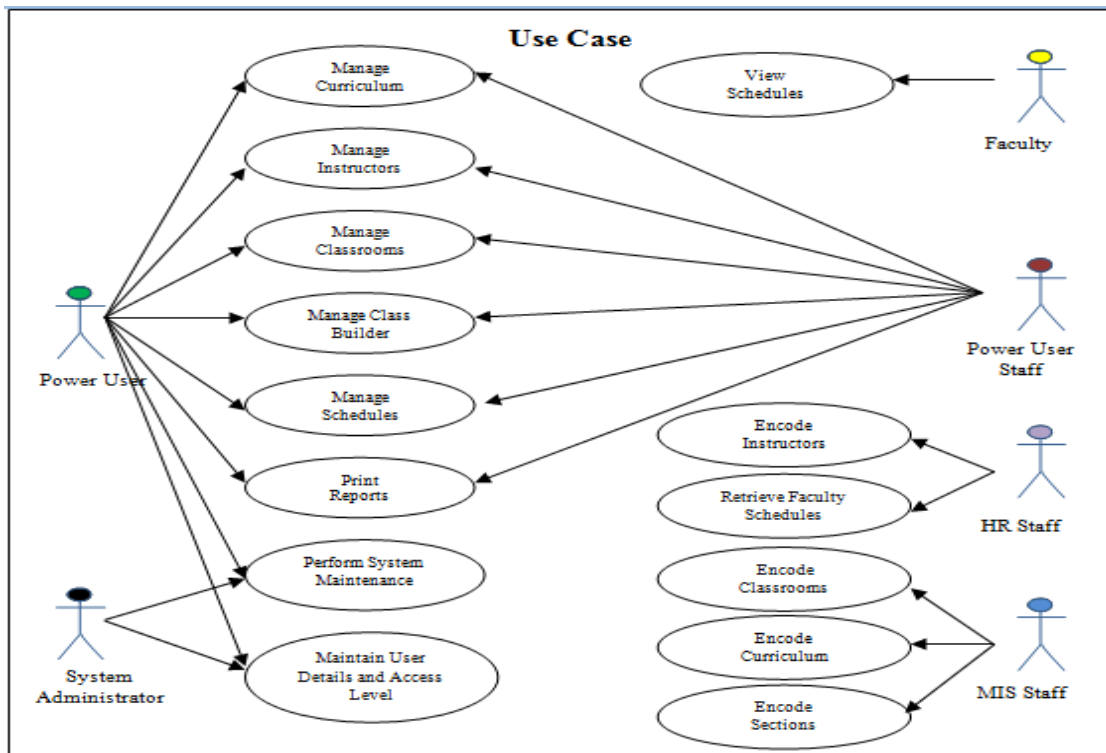


Figure2. Use Case Diagram of the Integrated Scheduling System

To show the interaction between the objects: Power User, MIS Staff, HR Staff, Server Computer via private virtual network over the progression of time, a sequence diagram as shown in Figure 3 was developed. The HR Staff is provided with user name and password that will be used in encoding faculty profile while the MIS Staff is also provided with user name and password so as to be able to encode all the available sections and classrooms in their College or University. Curriculum for each course Offerings is to be encoded to by the MIS Staff. After all those required entities are entered into the system, the power user could now manage those inputs using the appropriate system module for the generation of schedules and other pertinent reports.

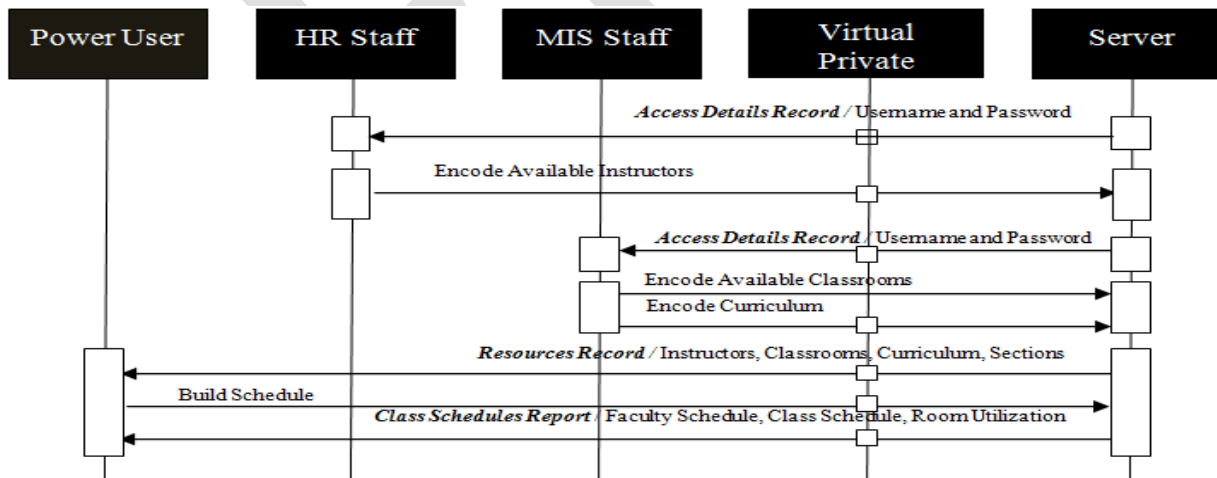


Figure 3. Sequence Diagram of the Integrated Scheduling System

Testing and Evaluation

After the development process, the system was tested and evaluated using ISO 9126 Software Quality Assurance Model. Prototype testing was conducted in a State University with several satellite campuses within the same province. Ten system specialists, fifteen Department Heads under the supervision of the Office of the Academic Affairs who are directly responsible for the manual creation of schedules and five personnel from the Human Resource and MIS Department who are also among the end users were tasked to test and evaluate the system. Thirty faculty members also participated in the testing and evaluation. System’s functionality, usability, reliability, and performance were rated using the Likert Scale.

RESULTS AND DISCUSSION

The researcher used the Microsoft VB.Net Framework 2.0 from Visual Studio 2008 Professional Edition because it is designed for the developers working with users both in a stand-alone and in a networked setting. For the back-end application, MS SQL Server 2008 was used. In order for the system to be deployed securely from the main campus across different satellite campuses, data must pass through a Virtual Private Network.

The developed Integrated Scheduling System provides a faster and more effective way of creating class schedules for selected Colleges and Universities in the Philippines with satellite campuses than the traditional manual system. The system is designed to enable users from different campuses who are creating schedules to have a flexible and guided access to all resources such as rooms, sections and instructors; thus providing a more balance schedules for each resource.

Through the implementation of Virtual Private Network, any updates and changes in the schedules from the main system or server (ideally located at the parent campus) will be reflected immediately on all other client computers at satellite location since real-time data can be retrieved from the system's central database.

The following features and functionalities are integrated into the system to achieve maximum performance:

1. The user can configure the connection settings if the main system is transferred or in another computer. The main system has the capability to search for the SQL server connected to the LAN or VPN set-up.
2. The system has capability to auto generate the section list and starting of new school year given the details by user.
3. The system has the capability to switch between the current semester and the upcoming semester, and allow user to set schedules in advance without affecting the current schedules.
4. The user can specify the teaching loads and working days of each instructor.
5. The user can set the subjects of an instructor based on their preferred subjects to teach.
6. The user can set the section or group for a particular instructor. The system has the capability to check availability of each instructor based on their teaching loads set in the module of instructor constraints.
7. The user can switch to different tabs while viewing the schedules of each instructor and section. This tab helps the user to easily view and compare while plotting specific schedules.
8. The user can easily choose what schedule to edit, using either the instructor module or the section module.
9. The user can choose whether to split a class into two meetings in two different days, or join two classes of the same subject with different days in one day.
10. The system has the capability to update all schedules involved when a schedule is edited by the user.
11. The system has the capability to detect conflicts automatically while plotting schedules.
12. The system has the capability to prompt or notify the user immediately after plotting in an unavailable schedule slot.
13. The system can generate specific reports for instructor, section or room schedule.
14. The system has capability to export specific schedule reports into MS Excel Application.
15. The user can specify the columns to print in the details of instructor and room.
16. The system has ability to save the users activities such as adding and editing of records. The activity logs can only be viewed and printed by the system administrator.
17. The system has the capability to limit actions or activities of user by setting access rights in each module. Access rights include actions such as adding and editing records and viewing and printing particular reports.
18. The user can do database back-up and restore.
19. Users could change the current themes of the system and could also upload their own school logo.

Figures 4, 5, 6 and 7 show some sample screen shots of the system featuring its major functionalities.



Figure 4. Main Module of the System



Figure 5. Resource Manager for Management of Instructors, Classrooms, and Curriculum



Figure 6. Module for the Class Builder



Figure 7. Module for the Schedule Manager

All system modules and functionalities were tested by the respondents who were chosen both from the main campus of the university and from its satellite campuses. The overall rating is 4.54 interpreted as Excellent or Highly Acceptable.

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CONCLUSION

The system is equipped with powerful features that offer numerous advantages. The system will provide information or reports such as class schedules, instructors' schedules and room schedules in a more efficient way which makes this computerized scheduling be potentially cheaper than that of the traditional manual way in the long term. Aside from providing a new, easy and quick way of creating and generating schedules, it also allows users to automatically detect and prevent conflicts upon the creation of timetable.

The system which was developed using VB.Net and MS SQL should be implemented across different campuses via Virtual Private Network. This network infrastructure would allow seamless access of information from the database anytime whenever needed.

In terms of acceptability to the end users, an Excellent or Highly Acceptable rating was given by the respondents.

REFERENCES:

- [1]. Bunag, E. H., Dionisio, A. A., Fajardo N. C., Natividad, L. P., & Villanueva, C. C. (2006). Scheduling System of Liceo de Pulilan HS Department. Bulacan State University. Malolos City, Bulacan.CICT, p. 10, 18. (Unpublished undergraduate thesis).
- [2]. Dela Cruz, R. S., Gatchalian, C. B., Meneses, M. C., Puno, P. C., & Salamat, J. D., (2009).Online Class Scheduling System for CICT. Bulacan State University. Malolos City, Bulacan. CICT. p. 56. (Unpublished undergraduate thesis).
- [3].Aldala, R. B., Angeles, A. L., Epifanio, C. R., Faustino, J., & Jose, J. P., (2006). College of Industrial Technology Scheduling System. Bulacan State University. Malolos City, Bulacan. CICT. pp. 3-4. (Unpublished undergraduate thesis).
- [4]. Gagno, P. A. M., Naval, R. T. B., Batista, P. C. Jr., Sarmiento, L. M., & Tesoro, S. K. M. (2006) CSS: Multi-Objective Course Scheduling System. University of the Philippines – Diliman. (Unpublished undergraduate thesis).
- [5] Cambazard, H., F. Demazeau, N. Jussien, and P. David. (2004). *Interactively Solving School Timetabling Problems Using Extensions of Constraint Programming. Practice and Theory of Automated Timetabling V*. LNCS. Springer-Verlag. pp.190-207.

- [6] Wren, A. (2006). *Scheduling, timetabling and rostering - a special relationship?* Practice and Theory of Automated Timetabling. First International Conference. Selected Papers. Springer-Verlag, Berlin, Germany; pp. 379.
- [7] Abdennadher, S. & Marte M. (2000). *University Course Timetabling Using Constraint Handling Rules*. Journal of Applied Artificial Intelligence. 14(4), pp. 311.
- [8] Ali Al-zou'bi, S. M. (2008): *Web Based Timetable Scheduling System for Applied Sciences at the College of Arts and Sciences (CAS)*, Universiti Utara Malaysia.
- [10] Jose, Alberto Ramon, (n.d), *Beyond the Numbers :Understanding the Changes in Philippine Population*, [Web log post]. Retrieved June 20, 2013. http://www.nscb.gov.ph/beyondthenumbers/2012/11162012_jrga_popn.asp
- [11] Higher Education in Numbers. (n.d.). *Higher education Institutions*. Retrieved June 20, 2013 from <http://www.ched.gov.ph/index.php/higher-education-in-numbers/higher-education-institutions/>
- [12] *Florida Gulf Coast University Charlotte Campus – Why need for a Satellite Campus?* Retrieved from <http://fgcucharlottecampus.tripod.com/id4.html> on July 17, 2013
- [13] Burke, E., Elliman, D. Weare, R. (2000). *Automated Scheduling of University Exams*. Department of Computer Science, University of Nottingham.
- [14] Schaerf, A. (2005). *A Survey of Automated Timetabling*. Artificial Intelligence Review. 13(2). pp.87-127.
- [15] Carter, M., and Laporte G. (2006). *Recent Developments in Practical Course Timetabling in Practice and Theory of Automated Timetabling II*. Springer-Verlag : LNCS 1408. pp 3-19.
- [16] Blanchard, B. S., & Fabrycky, W. J.(2006) “*Systems Engineering And Analysis*”,(4th ed.) New Jersey: Prentice Hall. p.31