Academic Workload Distribution Using ERP-Based System in Higher Education

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**Abstract.** This paper presents an Enterprise Resource Planning (ERP) based Academic Workload Distribution System developed for the Faculty of Computing (FK) at Universiti Malaysia Pahang Al-Sultan Abdullah (UMPSA). The system addresses the challenges faced by department heads in efficiently managing academic workload distribution. The system allows the head of department to manage lecturer information, handle subject details, allocate teaching workloads, and generate detailed reports for teaching workload distribution. Rapid Application Development (RAD) methodology was employed in building the platform, allowing for changes during development while meeting the six-month deadline. This approach helped the head of department to simplify administrative decisions and improve the workload distribution into a fair and transparent allocation among faculty members. This paper focuses on the ERP-based system in allocating the academic curriculum, which makes things easier for the head of department's decision-making process and reduces the workload of other lecturers for a more balanced workload among all faculty academic members.

# INTRODUCTION

Enterprise Resource Planning (ERP) systems are flexible, modular applications that unify and manage an organization’s primary business activities by storing and processing information in a centralized system [1]. Operating in multiple locations or across different shifts can make it difficult to manage information effectively. This lack of control often leads to inefficiencies in management, leading many organizations to implement an ERP system [2]. Rapid technological advancements have pressured Higher Education Institutions (HEIs) to change their usual managerial practices. The current scene of higher education has undergone constant change to satisfy the demands of digital transformation [3]. Technological advancement products can be upgraded by converting manually operated systems into automated systems. ERP systems improve staff productivity and organizational communication while helping users to save time for managing business activities and data [2].

According to [4], ERP is an alternative in managing the resources and business activities. ERP-based system helps HEI to improve the management of a number of procedures, including student registration, fees, the library, student grades, courses, timetabling, and staff-related concerns. By linking all of the HEIs units, departments, and sub-systems into a single database that operates as a fully integrated system, an ERP system is introduced to assist HEIs in overcoming several challenges [5]. ERP systems help to produce essential reports for resource allocation and effective decision-making. Most of the HEIs are forced to build on their IT skills to compete among them because they are highly reliant on information technology advancements [6]. A company can increase its overall efficiency and gain a competitive advantage through technological innovations, such as introducing ERP systems [7]. In HEIs, ERP allows administrative activities such as managing student modules for enrollment, academic records, and scheduling. However, in most business activities, ERP focuses on inventory management, sales, and supply chain without requiring customer interaction [2]. The advancement of ERP systems, which are highly customizable and designed to manage various functions tailored to the specific needs of different organizations, has increased demand across a wide range of sectors.

In FK UMPSA, every department in the faculty must allocate the registered subjects for the lecturer based on their teaching workload. The faculty use manual systems during the subject distribution process, which is time-consuming in revising the subjects based on the instructor’s specialization, room utilization, and the instructor’s load. This process is a complex task with many inputs that require action to be taken and needs deeper consideration. As the complexity of the process increases, the difficulty in the decision-making process also increases. Since the decisions made only rely on the person in charge and are not recorded in any enterprise system, we can only depend on that person if any problem occurs in the load division process. Thus, many higher education institutions in one of the international countries have adopted ERP systems as the latest technology to boost efficiency and increase productivity [8]. This research focuses on the Software Engineering (SE) department at FK where the teaching load assigned to the lecturer lacks the essential requirements to form a satisfactory workload. The teaching load is given without considering the lecturers’ expertise and is not evenly distributed. Therefore, to address the issue, a system using an ERP-based concept was proposed as a recommendation to solve the problem raised and was introduced to SE department in FK UMPSA.

# RELATED WORKS

## Enterprise Resource Planning

Enterprise Resource Planning, which synchronizes, integrates, and optimizes the organization's data and operations into a unified system, is also recognized as a strategic instrument for gaining a competitive advantage in an unstable market environment [9]. It systematizes the operation process using all the resources for the entire organization and provides support by offering access to a single data repository [10]. The ERP system offered users flexible, controlled access and essential modules to facilitate the smooth execution of daily business operations [2]. It has been recognized as a comprehensive suite of business tools that enhance various organizational functions, including product development, accounting, inventory management, procurement, production planning, human resources, materials management, and sales and marketing. Any successful corporation needs an ERP system to manage its intricate business procedures [11]. Hence, the growing pressure on HEIs to enhance administrative efficiency and improve service quality for students and staff has created a demand for the adoption of ERP systems as a strategic response [12].

## Enterprise Resource Planning in Higher Education Institutions

The adoption of ERP systems in HEIs is driven by multiple factors, more precisely by worldwide trends after the COVID-19 pandemic, which has highlighted the need for institutions to undergo digital transformation in all areas of operation [13]. In higher education, ERP systems generally involve the integration of data related to students, both academic and non-academic staff, financial transactions, document management, and various registration processes [14,15]. Over the past five years, several researchers have proposed and implemented ERP systems as tools to support digital transformation in HEIs.

Budiman et al. [16] implemented an ERP system to help Indonesian universities meet accreditation requirements. The system connects various university departments, such as academics, HR, finance, research, and community service, through RESTful API web services. This allows it to automatically gather the data needed for the nine accreditation criteria set by the National Accreditation Agency for Higher Education in Indonesia. The system reduces manual work, avoids duplicate data, and improves accuracy. A trial with ten study program managers showed that the system made the data collection process faster and more effective. It also helped present information clearly for required accreditation reports like the Self-Evaluation Report and the Study Program Performance Report.

According to M et al. [17], a cloud-based ERP model was developed to support women’s higher education in rural areas, with a case study from an Indonesian university. The system includes core educational functions such as student enrolment, course management, and administrative tasks. Key features involve mobile access, real-time online data processing, and centralized information management, all hosted on the cloud to minimize local resource demands. The implementation increased operational efficiency, reduced IT costs, enhanced data security, and improved educational access for women in remote regions. Overall, the model shows that cloud-based ERP systems can effectively help bridge educational gaps in underserved communities.

Huang et al. [18] proposed a Cloud-based ERP system in the Australian higher education sector, specifically at the University of Technology Sydney (UTS). The ERP model implemented was the Software-as-a-Service (SaaS) model delivered via a cloud platform. The system included core features such as finance, human capital management, and student administration modules. The implementation yielded significant results such as increased system agility, reduced IT infrastructure costs, and improved data accuracy and reporting. The benefits extended to enhanced user satisfaction, scalability, and alignment with institutional digital transformation goals.

Lamey et al. [13] explore the successful implementation of an ERP system at ABC University in Egypt guided by Enterprise Architecture principles. The selection process was based on a careful evaluation of critical criteria to ensure alignment with the university’s strategic objectives. The study highlights the use of the Smart University Reference Architecture (SURA), a specialized model for higher education, as a key reference point. It highlighted that the chosen ERP system effectively supported the university’s digital transformation, improved operational efficiency, and enhanced information flow across departments.

Subhani et al. [19] discuss the implementation of the Oracle PeopleSoft Campus Solutions ERP system at the University of the Punjab, Pakistan, as part of a pilot project by the Higher Education Commission across six public universities between 2007 and 2009. The study uses the Unified Theory of Acceptance and Use of Technology (UTAUT) model, which combines eight technology acceptance theories to analyze employee responses. The ERP system integrated key university operations such as HR, finance, supply chain, and student services. Findings showed that all UTAUT factors, such as performance expectancy, effort expectancy, social influence, and facilitating conditions, positively influenced employee behavior, with behavioral intention playing a partial mediating role and experience moderating the relationship. The ERP brought benefits like improved processes, better client management, and greater collaboration. However, adoption in public universities was lower than in private ones, mainly due to management challenges, lack of training, limited funding, and resistance to change.

# METHODOLOGY

Academic Workload Distribution System project development is implemented using Rapid Application Development (RAD) method to support the software development life cycle. RAD approach is used to build a system in a limited time, which emphasizes business needs, quality-driven development, incremental and iterative progress, and direct feedback based on agile principles [20]. This method was implemented because the system was expected to be developed within a limited timeframe of less than six months. The RAD approach delivers outcomes more quickly and of higher quality than standard cycles. It is a software development methodology using minimal planning based on rapid prototyping and iterative development. Additionally, the method focuses on gathering user requirements to develop a product that satisfies users’ needs. The system development process for RAD has no specific preplanning, which makes it easier to incorporate change during the process.

Figure 1 shows RAD model involves four phases consist of requirements planning, design, build, and test. The primary respondent for this project is the Head of SE Department as the target user. The Requirements Planning Phase involves gathering relevant information for ERP analysis, defining the scope of the Academic Workload Distribution System, and determining system rules and requirements from the target user. After proper planning, user approval from management is required to proceed with the next phase. In the System Design Phase, the user collaborates with the developer to create models and prototypes that translate user needs into fully functional designs. Then, proceed with the System Development Phase, where the system is built using Microsoft Visual Studio (VS) as the integrated development environment (IDE), which supports coding and interface design. User interfaces are designed directly within this environment, and the system operates through this platform. MySQL Server is employed as a back-end database to enable reliable and efficient data management. The VS connects to the MySQL database using connect() method. The data related to lecturers and subjects is used as input and stored in the database in a structured table format. Upon executing the implementation code in VS, a file with “.db” extension is created which stores information about the saved data. Testing is conducted in stages, including initial system execution to check for any issues until the system is free from error. User acceptance testing (UAT) is conducted to validate functional requirements and ensure compatibility with the user's work environment. Finally, the Cutover Phase involves finalizing an error-free system build and providing training to the target user to ensure the successful adoption of the Academic Workload Distribution System.

**FIGURE 1.** Rapid application development model

# RESULT AND ANALYSIS

Following the ERP-based concept, the system is customized and structured according to its specific requirements, organized into three core modules: Master Lecturer, Master Subject, and Subject Distribution. Figure 2 presents the Master Lecturer module that enables users to perform CRUD which stands for Create, Read, Update and Delete operations on lecturer profiles. This module enables users to manage lecturer information by capturing details of personal information of SE department lecturers including mandatory fields such as personal data and profile photo uploads. As shown in Figure 3, the Master Subject module allows the user to select a lecturer's name and define a prioritized list of subjects based on the lecturer’s expertise and preferences. When the Save button is clicked, the data is stored directly in the database and is reflected in the Subject Distribution module. The system also provides a function to view the list of registered subjects. Once subject priorities are set for each lecturer, the Subject Distribution module as shown in Figure 4, enables the user to allocate subjects according to the defined preferences. This ensures that lecturers are assigned only to subjects within their areas of expertise. The system also implements rules on maximum teaching loads to ensure assignments do not exceed each lecturer’s capacity. A home button is included in each module for quick navigation back to the main interface to enhance user-friendliness. The Save button commits the data to the database and the View Report button directs the user to a separate form for generating the Subject Distribution Report, as shown in Figure 5. This report can be printed for office use, making it easier for the user to share the distribution list with all lecturers. Previously, all allocation tasks were handled manually which led to inefficiencies, errors in the distribution of workload and difficulties in accessing and sharing accurate data. Overall, the system helps head of department, the system helps balance workload assignments, improve the accuracy and accessibility of academic data for better decision-making by utilizing an ERP-based approach.

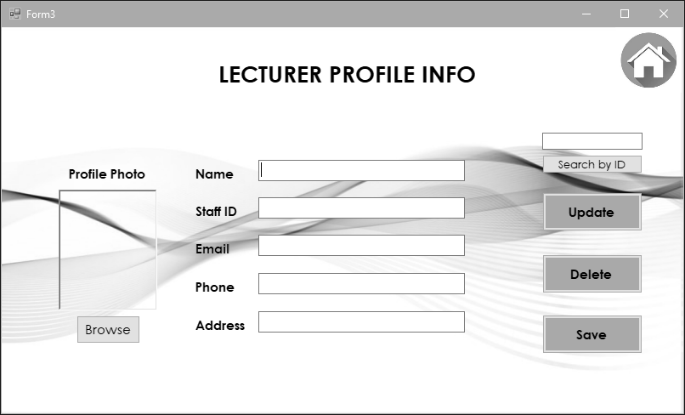
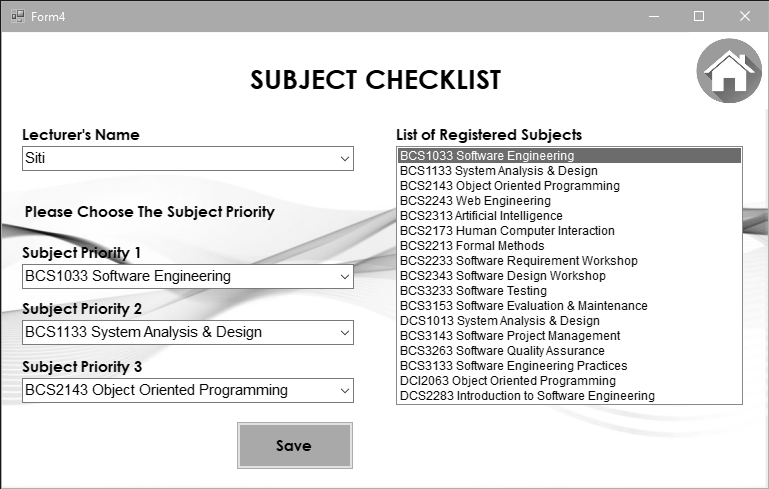


FIGURE 2. Master lecturer module

**FIGURE 3.** Master subject module

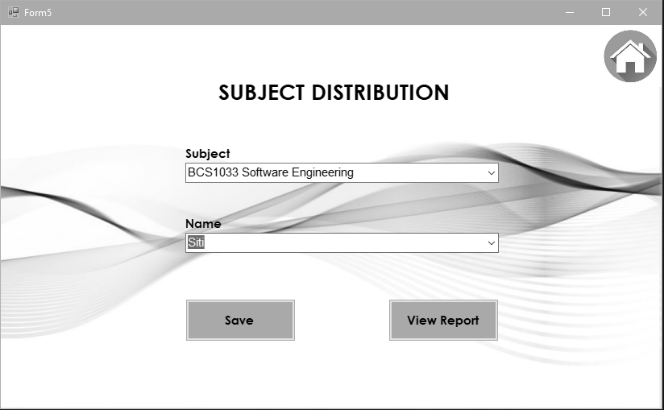


FIGURE 4. Subject distribution module

A screenshot of a cell phone

Description automatically generated

FIGURE 5. Report on subject distribution

# CONCLUSION

The development of the Academic Workload Distribution System for the SE Department in FK UMPSA using an ERP-based concept has demonstrated its effectiveness in supporting the Head of Department in managing and distributing teaching workloads based on lecturer expertise and subject priority. Built using the RAD methodology and implemented with Microsoft Visual Studio, the system streamlines the allocation process, reduces administrative burden, and enables faster and more informed decision-making. With integrated modules of Master Lecturer, Master Subject and Subject Distribution including centralized data access through a MySQL database, the system aligns with ERP principles to facilitate better academic administration and information access using a single database access. However, apart from all these benefits, there are some limitations such as restricted search functionality and limited subject priority selections. The search capability in the Master Lecturer module is limited to staff ID which restricts flexible access to lecturer data. Furthermore, users can only assign exactly three subject priorities which may not accommodate varying instructional needs. Despite these limitations, the project successfully achieves its intended goals and provides a strong foundation for continued development and research in Academic Workload Distribution Systems. Further improvements could focus on enabling more flexible input for subject priorities and refining the subject assignment logic to ensure more balanced workloads, particularly by prioritizing lecturers with fewer assigned subjects. Future enhancements can also focus on the addition of a student module to manage student-related data such as financial records, academic results, subject enrolment and scheduling. The system also holds the potential to be scaled across all departments within the FK UMPSA.

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