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An Automated Management System for Student e-Services

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Abstract: This paper proposes and develops an automated management system for student services in an educational institution environment. In the proposed system, students can share various services including sharing of study materials, requesting and signing up for a course, requesting a locker, uploading portfolio documents, searching for finished capstone projects and joining internship programs. This work builds and designs a database and transforms a current mechanism into a robust computerized system. It will help in easing and automating the mechanism of service activities by replacing the traditional paper-based system. The proposed system has been initiated by surveying the necessary requirements in the design of the system. It is then followed by building a database. Various other phases have been incorporated which include planning, analyzing, and designing the system. The build system can be implemented in any environment with some specific orientations according to required needs. The proposed system is secure, robust, accurate and efficient. It is accessible through web from anywhere and anytime.

Keywords: Management system, e-services, education, database, software.

1 Introduction

As technological advances growing with passage of time, there is a need that everyday processes, businesses and services evolve accordingly to walk along such advancements. Similar scenario is expected for student services in universities which requires the need to design and build a user friendly system. Designing and building a system for student e-services makes the everyday life easier [1-15] for the educational institutions to manage their frequent activities and services efficiently. It will imply that the students, student union and university administration will be able to interact, communicate, help and monitor their activities related services. It will help generating error free outcomes which may not be the case with manual processes and practices.

Various authors have worked, in different real-life scenarios, towards developing systems based on database designs. For example, for a restaurant scenario, Ashutosh et al [2] explore that development of a databased system has high probability towards increasing the sales. They believe, in this way, that the restaurants can manage to approach potential customers excessively using online services. Another finding by Levandoski et al. [3] outlines that many of the restaurant owners are more used to the traditional paper-based system. Such systems are always prone to various deficiencies like misplacement, loss, and damage. It is not easy to go through the information on paper. That is why, there is a need for computerization. Designing databased systems is the highly effective and preferable approach to manage and keep data for various entities including home-based restaurants or so.

In today's life scenario, it is not easy to keep the information on paper. This is what triggers why it is essential and preferable to have an online computerized system based on a database design. It is going to be suitable for every organization, no matter small or big. For example, a database application system was developed in [9]. It evaluates the contents for the work done by students. It was meant to effectively perform the responsibility of the departments. It covers various basic student information to effectively manage and process. It meets the requirements of how student workers operate and was useful to carry on the data processing. A feasible solution was provided in [10] for the development of a teaching management system. It was achieved by designing a database with a nice structure, storage efficiency and independence.

An automated system is assisted by computers, it allows the data to flow in an efficient way [4, 11, 12, 13]. Designing, building and implementation can be assisted by various

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technologies to lead towards a computer-based system for automated student management systems. To develop the proposed system, some important tools have been utilized to configure the database, design interfaces and various graphics objects. For example, SQL (Structured Query Language) is used to communicate with database. Toads is utilized to create, develop, access, manage, and analyze data. The tools such as HTML, CSS, JSP were used, as the primary programming languages, for creating the website for the developed system. Sublime was used, as text editor, for coding. Photoshop enabled various designing objects including icons, pages, etc.

In this work, we aim to develop an automated management system for student services in an educational institution environment. The students, student union and administration can share various services including study materials, requesting and signing up for a course, requesting a locker, uploading portfolio documents, searching for finished capstone projects and joining internship programs. The objective, in this paper, is to introduce and deliver a friendly and efficient system so that there is a significant enhancement in productivity for University students, student union, administration, or other users as need be. It is also targeted to provide the capability of summarizing all required information in reports to help the university community for making suitable services and decisions.

In this work, we build and design a database and transforms a current mechanism into a robust computerized system. It will ease, help and automate processing the service activities by replacing the traditional paper-based system. The proposed system has been initiated and strengthened by a survey that helps to find out the necessary requirements to design the system. It is then followed by building a database. Then, various other phases have been incorporated which include planning, analyzing, and designing the system. As far as implementation of the proposed system is concerned, after consideration and evaluation of numerous existing technologies, we decided upon the most popular and beneficial options to build the proposed system. As a case study, Kuwait University of Kuwait is taken as an environment. However, the build system can be implemented in any other environment with some specific orientations according to required needs. The proposed system is secure, robust, accurate and efficient. It is accessible through web from anywhere and anytime.

The rest of the paper has been organized in numerous sections for its contents. Section 2 highlights the designing of the proposed system and its working assessment. Section 3 provides an overview of the proposed system and necessary requirements. The logical design and physical structure have been constructed in Section 4 for the newly proposed system. One of the major contributions is towards implementation of the system, this key phase is handled in Section 5. This phase, in addition to the description of implementation, also includes the demonstration of the proposed system. Last but not least, the paper is concluded in Section 6.

2 System Design and Assessment

This section is dedicated for the discussion on the end-users of the proposed system together with analysis on its cost and benefits. We will also look at the potentially possible technical risks together with the aspect of minimizing them.

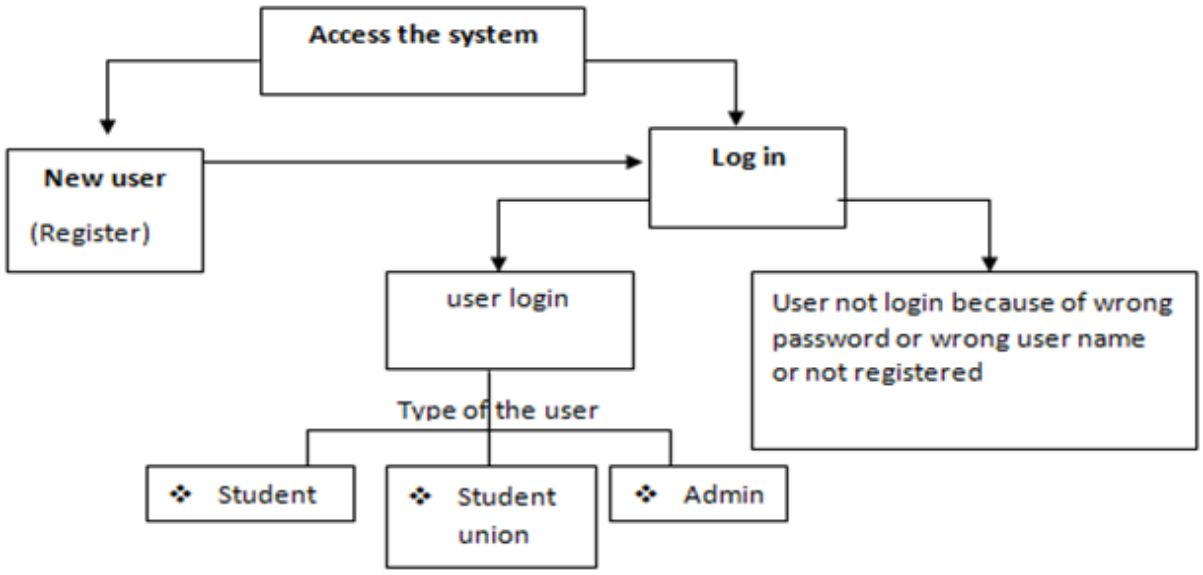


Figure 1. Snapshot showing the mechanism of the system design.

The end-users, in this system, are the university students, student union and administration. The system is developed for accessibility by a website. It is a self-serving system which can be globally accessed anytime. Using this system, the students can share and ask for study materials, request and sign for a course, request a locker, upload portfolio documents, search for finished capstone projects and join internship programs. Student Union can also share materials and collect the lockers requests in addition to uploading finished capstone projects. Moreover, department administration can receive requested courses and can take all necessary actions to offer the requested courses for the coming semesters. Posting the news and events, on the system, is also one of the important features. Figure 1 demonstrates the flow of the working of the system. The breakdown of the analysis of cost and benefit is shown in Table 1. It estimates the value of benefits and their corresponding costs for the system proposed.

Table 1. Analysis of the Cost & Benefits for the System.

Description of Items	Needed	Not needed
Network Technician	X	
Labor for Computer Operations	X	
System Manager	X	
Assistant Manager		X
Staff to assist	X	
Software Licenses	X	
Software Upgrades	X	
Hardware Upgrades		X
Training for Users	X	
Communication Charges		X
Miscellaneous Expenses		X

It is very likely to have some of the risks. For example, there is a possibility that the developer expertise is insufficient for total implementation of the system for the needed requirements. Additionally, while changing from paper-based to a computer based system, might cause some security issues. To mitigate these this risk, the proposed system has set security measures of some kinds at different levels. For example, it provides Login feature together with Access at various levels including Student, Admin, Student union, etc. It would the data administrator of the system who would allow access permissions to change application data. In addition, for Password requirements, each user has a password. We also prefer using anti-virus software to protect and secure the system as far as documents and personal information are concerned.

It has also been provisioned in the system design to havevarious kinds of non-functional requirements (NFRs) into account. Performance, Security, Availability, Integrity, Recoverability, Usability, and Maintainability have been included as NFRs in the proposed system. Details of each of the NFRs is explained in Table 2.

Table 2. Description of the non-functional requirements of the proposed system.

NFR	Description
Security	▪ Login / Access levels (student, Admin, Student union.) ▪ It is the system's data administrator who has access permissions to change the application data. ▪ Each user has a password as the password requirements.
Performance	▪ Application loading and browser refresh make good response times. ▪ Functions executions, imports and exports have good processing times. ▪ Query – initial loads and subsequent loads (for example searching for a course, capstone, etc.)
Availability	The system is available 24/7
Recoverability	▪ There is a recovery process. ▪ There are backup frequencies for daily backup, materials, portfolios, etc.)
Integrity	▪ It has integrity for applications. ▪ There is data integrity which is needed for referential integrity in interfaces and database tables. ▪ There is information integrity for transformation duration.
Maintainability	Conformance to coding standards using html and CCS for website interface and for the database SQL
Usability	▪ User Standards (Look / Feel) ▪ Use bilingual (Arabic & English) so all student can use it

3 System Requirements

There is a need to have requirement collection process to be described in this section. The system contains different functions to achieve the goals. Each part has different roles and functions. The system also interacts with different users, as shown in the use case diagram Figure 2, and each one of them has a role.

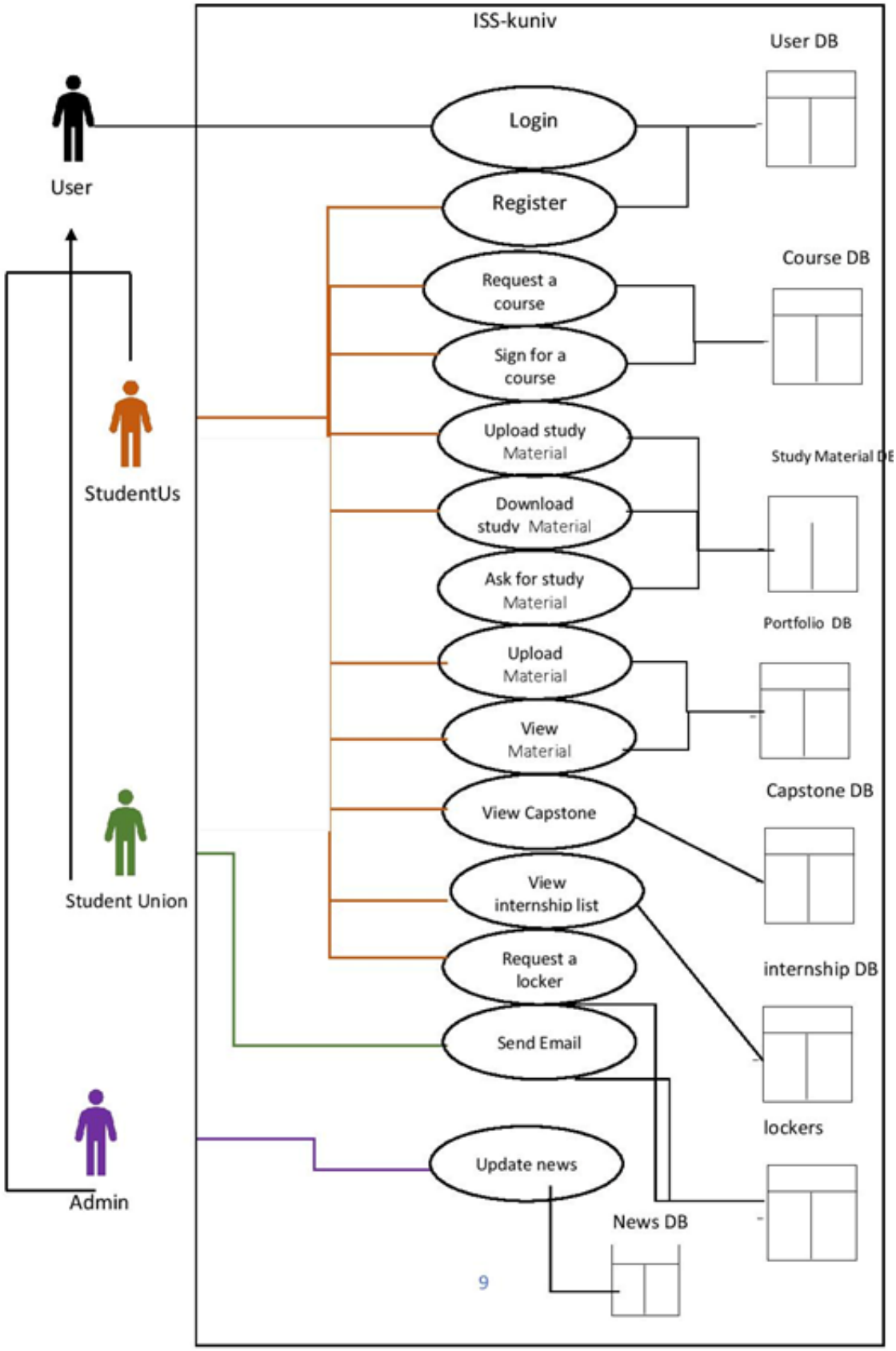


Figure 2. System's use case diagram.

3.1 Main Pages in the System

The main pages in the system are displayed in Figure 3. These pages are explained as follows:

- **Home Page**: The main page of the website (system) which contain news and upcoming events.
- **About Page**: It contains information about the missions and visions of the College.
- **Login Page**: After registration, user can access to the system and the entitled pages on the system.
- **Registration Page**: Student can register in the web site by filling the form. They can subscribe in newsletter.
- **Seniors Page:** It contains subpages as follows:

  1) Portfolio Page

  It is like a storage for all departments in Collage of Computing Sciences and Engineering. Also, it used as a solution for losing papers like exams, homework and projects.

  2) Capstone Page

  Student will be able to search and review the graduate student project/capstone with brief description about each idea which can help them to decide what topic they will work on it.

  3) Internship Page

  The student can request for an employer to train him/her from the list that the department has announced. Or, he/she can request for a new employer.

- **Student Page:** It contains different subpages as follows:

  1) Lockers Page

  Once the students are accepted in the College, they can own locker until graduation. Through the website, a student must send a request for obtaining a locker. The student union member will receive the request, who will then contact the requester via email which has a locker's detail such as locker number and to whom to contact to get the key.

  2) Request a Course Page

  Student can request a course for the next semester either the course full or it's not in the schedules. Moreover, if the requested course is completed the system automatically sends email to the chairmen of the department.

  3) Material page

  Every student has their own materials such as Exams, Projects, HWs, etc. students able to share their materials between each other. So that, they can add materials by mentioning its type and providing a brief description about it. Also, students can ask for needed materials by selecting the name of the course and the type of what she/he need. Every attachment in this part will be available to view it by all the students automatically. In addition, each student can only remove his/her added materials.

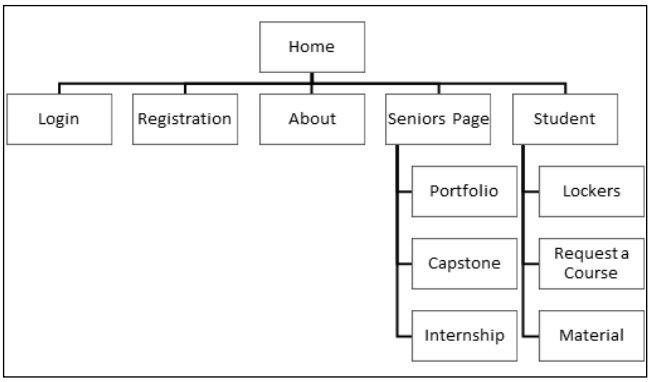


Figure 3. The pages interfaces in the system.

3.2 Requirements

The requirements of the Web based system are further refined and translated into conceptual models as follows:

a. The Student Service System keeps track for each student's name, student ID, phone, and Email. The student ID has unique value for each STUDENT.
b. Each course has a course name, course number and Course ID. The value of Course ID and Department ID are unique for each COURSE. Each course belongs to semester.
c. Each semester will have semester ID, year and semester name. The value of semester ID and year are unique for each SEMESTER.
d. Each locker has a locker ID and Locker status. The value of locker ID is unique for each LOCKER.
e. Each course material has course material ID, material file (the attachment), kind

(attachment, asked), status, Faculty name, Semester ID (first-second-Summer). All this information is optional for the student to fill, except the Material file. Any student can attach material to the system to publish it. The student ID and Course ID are recorded for each COURSE_MATERIAL.

f. Each portfolio has a portfolio item ID, portfolio file (attachment), portfolio file (description), portfolio type of file, file details and semester ID. Any student can have portfolio library and attach files in it. The student ID and Course ID are recorded for each item in the portfolio. The value of portfolio item ID is unique for each PORTFOLIO_ITEM.

g. Each indicator has indicatorID, departmentID, IndicatorType, and Description. Portfolio item is related to indicator. The value of indicatorID, departmentID, IndicatorType are unique for each INDICATOR.

h. Each Keyword has indicatorID, DepartmentID, IndicatorType, and Keyword. The value of indicatorID, DepartmentID, IndicatorType, and Keyword are unique for eachKeyword.

i. Each PostNote has postnoteID and Descreption. The value of postnoteID is unique for each POSTNOTE.

j. Any student can request a course in a semester. Each request course has a student ID, course ID, department ID and description. The value of student ID, course ID and department ID are unique for each REQ_COURSE.

k. Student attach material, the system keep track for attach date.

l. There is a request material. System keeps track for student ID, course ID, department ID and post note ID as a unique.

m. Each post note has a posted date, status and description for the request.

n. When the student reserves a locker, the system will keep track for reserve date and the ID of the student union who accept the reservation.

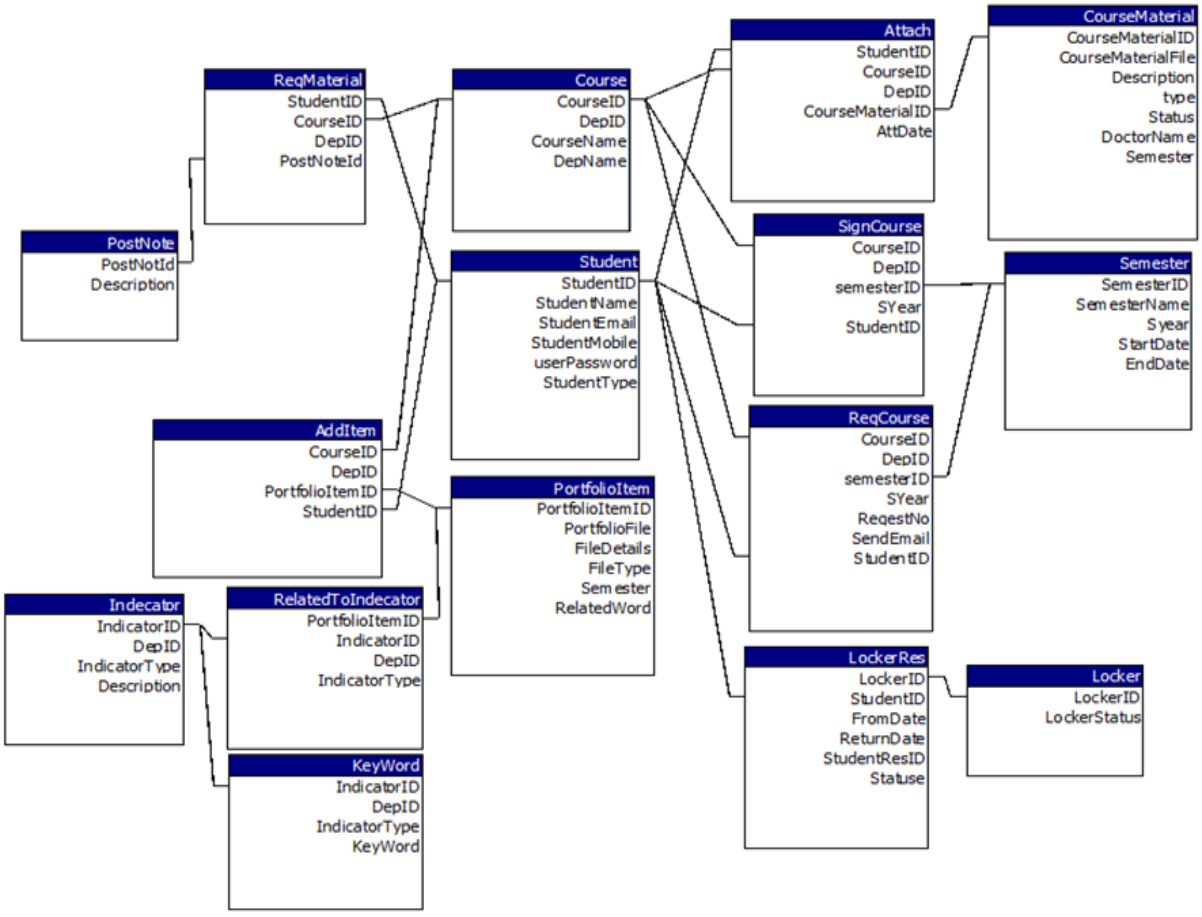


Figure 4. ER diagram for the Student Service System.

In this phase, both the data and functional requirements are produced which are the conceptual design. The data

requirements are used as the source for the design of the database. The data requirements for the system as shown above specified as detailed and complete as possible for the system. In parallel with the specification of data requirements, it is useful to identify the known functional requirements of the application. For the main functions which the system can handle are:

a) Create (Add): where user can create new request such as requesting new course or new study material

b) Update: where user can modify his/her information or the admin can modify the internship list

c) Delete: where user can remove his/her portfolio material

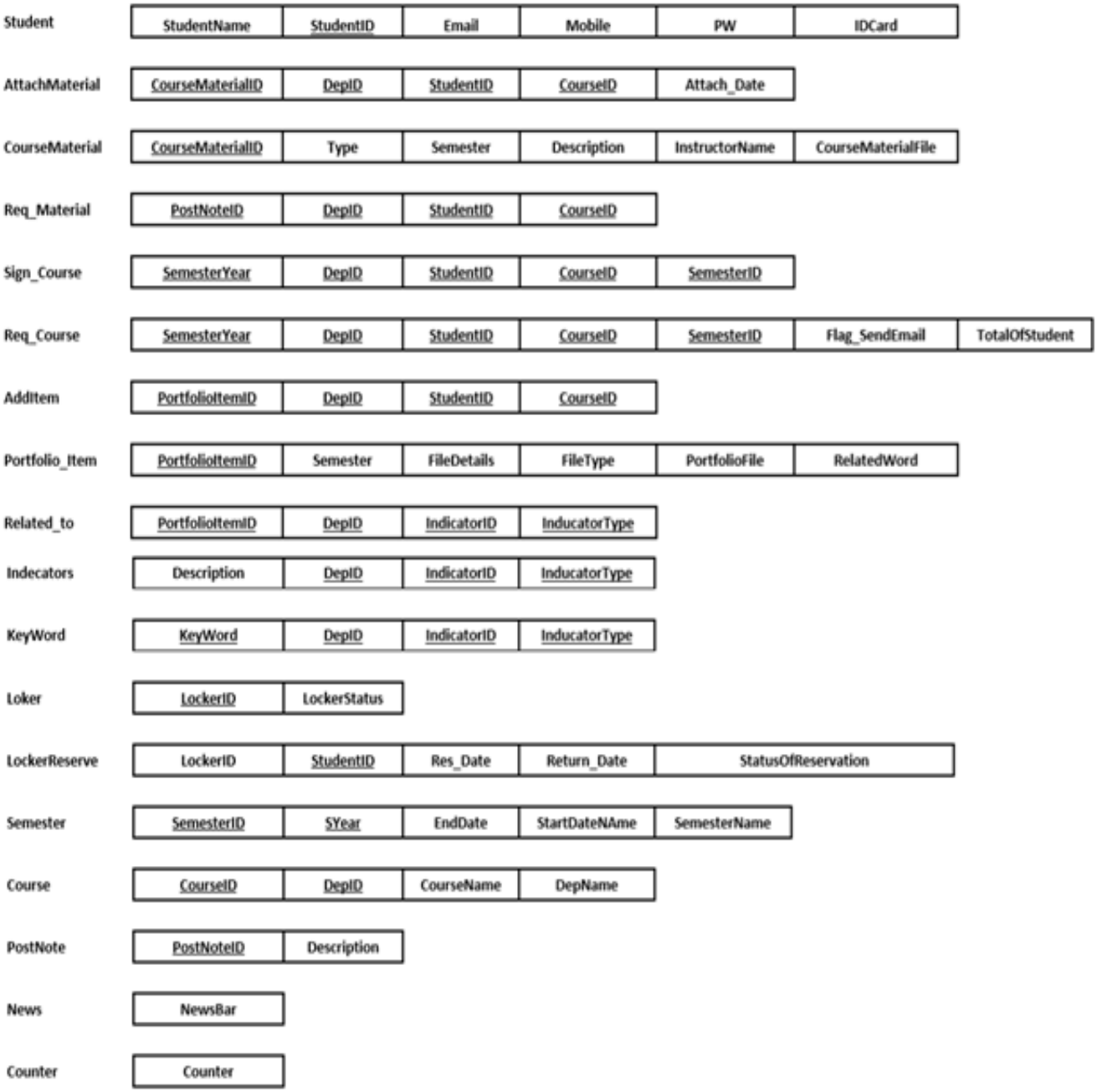


Figure 5. Normalized database design for the system.

4 Design

We discuss, in this section, the logical design of the system. It covers the system inputs, outputs, and processes [7-13]. Additionally, it covers the Entity Relationship (ER) diagram. The resulting normalization is also part of it. Last but not the least, we have also outlined the physical design and system implementation.

4.1 Logical Design

The student service management system has an interesting mechanism in terms of its inputs and outputs. The Database requirements, to create the Schema are shown in Figure 4 and entity relationship (ER) diagram is displayed in Figure 5.

4.2 ER Diagram

We have created an ER diagram, as can be seen in Figure 4, which explains all database flow and the data connectivity to each other. In this ER diagram, we map the relations together.

4.3 Normalization

After the creation of the ER diagram, normalization is done. It will help to organize tables to reduce the dependency and redundancy of data. The normalization process also divides larger tables to smaller ones and relationships are linked by using them. The resultant normalization of the ER diagram shown in Figure 4 is depicted in Figure 5. It illustrates the system's database schemas and set of the primary keys.

5 System Implementation

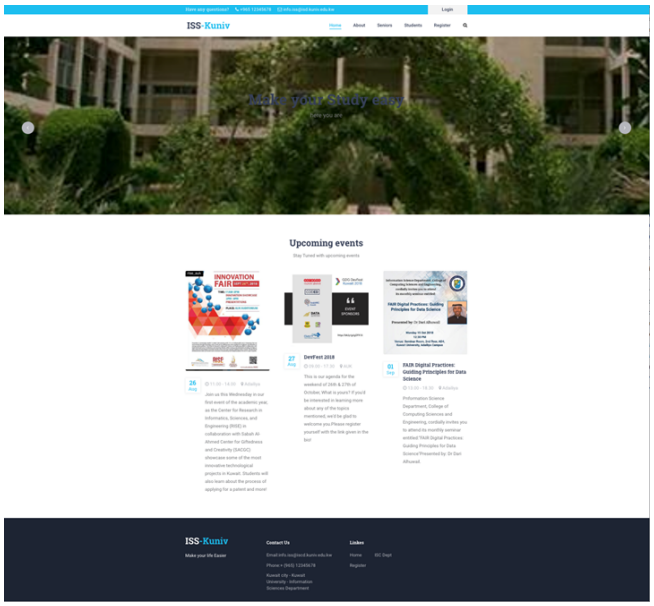
This section highlights the system and its development from scratch. One can see the resulting implementation is able to capture and implement all desired requirements for a student service administration system. The underlying database technology, together with web design technologies and programming languages, have been used in the development of a system that would fulfill all the system requirements. Here is the mention of the tools which have been used to configure the database and interfaces in the development of the system:

1. SQL: Structured Query Language is used to communicate with database.
2. Toads: create, develop, access, manage, and analyze data.
3. HTML, CSS, JSP: is the primary programming language we use it when creating a website.
4. Sublime: It a program that we will use it for coding (text editor)
5. Photoshop: for designing (icons, pages)
6. Internet: Connection.
7. PC: for coding
8. Server: Storage for Databases.

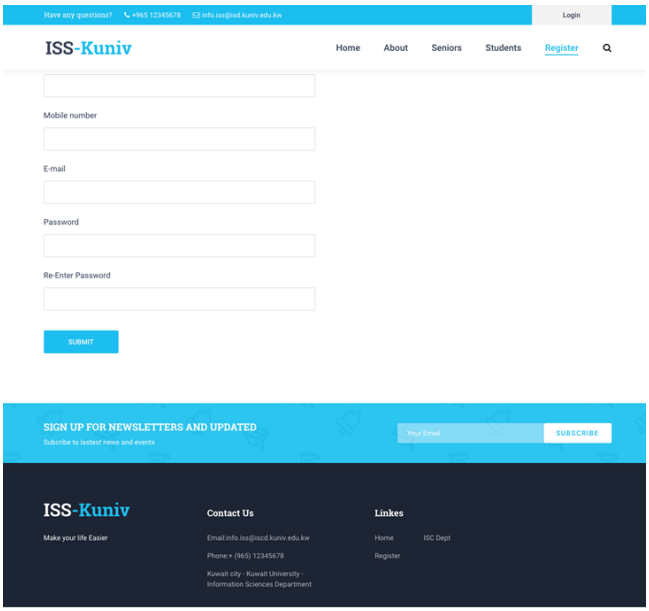
Table 3. Various inputs, processes and outputs of the System.

#	Input	Process	Output
1	Login information	a. Matched credential b. No match credential	a. "Welcome "ID number "!" b. "Sorry try again, you credential is not matched"
2	Sign in information	Check the information	User are created "welcome "ID number"
3	Request a course	Check the course information if: a. first time to request b. existed request	a. send the request to the department, "your request has been submitted" b. "Sorry, the course exists, you can sign on the course."
4	Sign on a requested course	Check the information if: a. first time to sign on b. existed request	a. "your request has been submitted" b. "Sorry you are already signed on."
5	Upload study material	Check the information if: a. Required fields are completed b. Errors (missing fields, size or type of the attachment)	a. "Thanks for sharing your material" b. "Error kindly check the required fields *"
6	Download Material	Check the link	Attachment downloaded, "The attachment was download"
7	View more details for a capstone project	Retrieve the information, jump to the chosen capstone project	Capstone details shown.
8	Request an internship program	Check information	Send the request to the department, "your request have been submitted.
9	Request a locker	Check information, send an e-mail to student union to process the request.	send an e-mail to student union to process the request." your request have been submitted. Student union will contact you soon."
10	Add news or events	Check the information	Create the event on the homepage "you event have been added"
11	Add news or events	Check the information	" are you sure you want to update the event?", event was updated.
12	Reserve a locker	Check for the locker states then reserve a locker for the requester	e-mail will send to the requester with the locker's details such as locker number moreover to whom to contact to get the key.
13	Signed on requested course is full	generate an e-mail sent to department	Department will receive the list of employee who request a course.

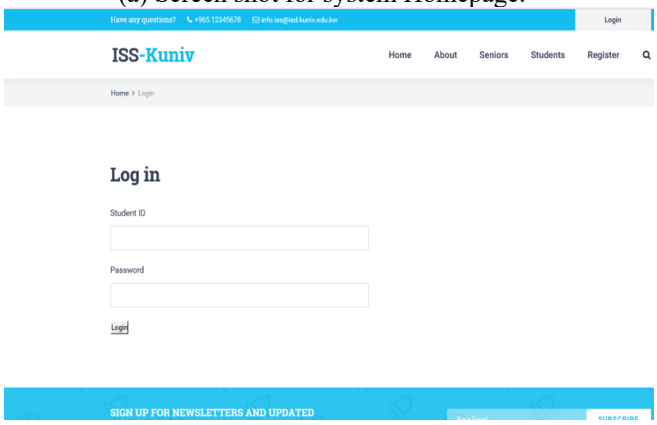
For the potential users, a windows application has been developed that interacts with the database and provides a Graphical User Interface. This application provisions everything to link the database, it facilitates all the processes. The proposed system has been evaluated very positively by the end-users. The system is such that it has various inputs, processes and outputs. These are shown in Table 3.



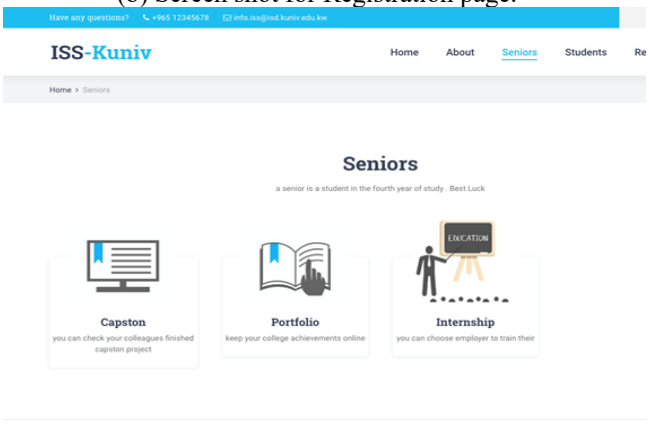
(a) Screen shot for system Homepage.



(b) Screen shot for Registration page.



(c) Screen shot for Login page.



(d) Screen shot showing the system page for "Senior students".

Figure 6. Demonstration of one set of screenshots of the system.

Figures 6-8 demonstrate screenshots of the proposed, designed and developed system. The screen in Figure 6(a) contains the main system Homepage. This is the main page of the System, user can know upcoming event or some of important news that announced.

The Register and Login screens are shown in Figure 6(b) and Figure 6(c) respectively. If it is the first time the user is visiting the website (system), user can register so that he/she can use the services by filling his/her information and click on submit button. However, if a user is already registered, he/she can login and use the services. By filling his/her information, the user has to click on login button.

The webpage for Senior students is displayed in Figure 6(d). This page serves for senior students with the important services such as Portfolio, Capstone Project and Internship.

Figure 7 demonstrates on "About us Page". It will let the users know about what they can expect from the system and some declaration about the services. This page also provides faculty information if anyone wants to communicate with them.

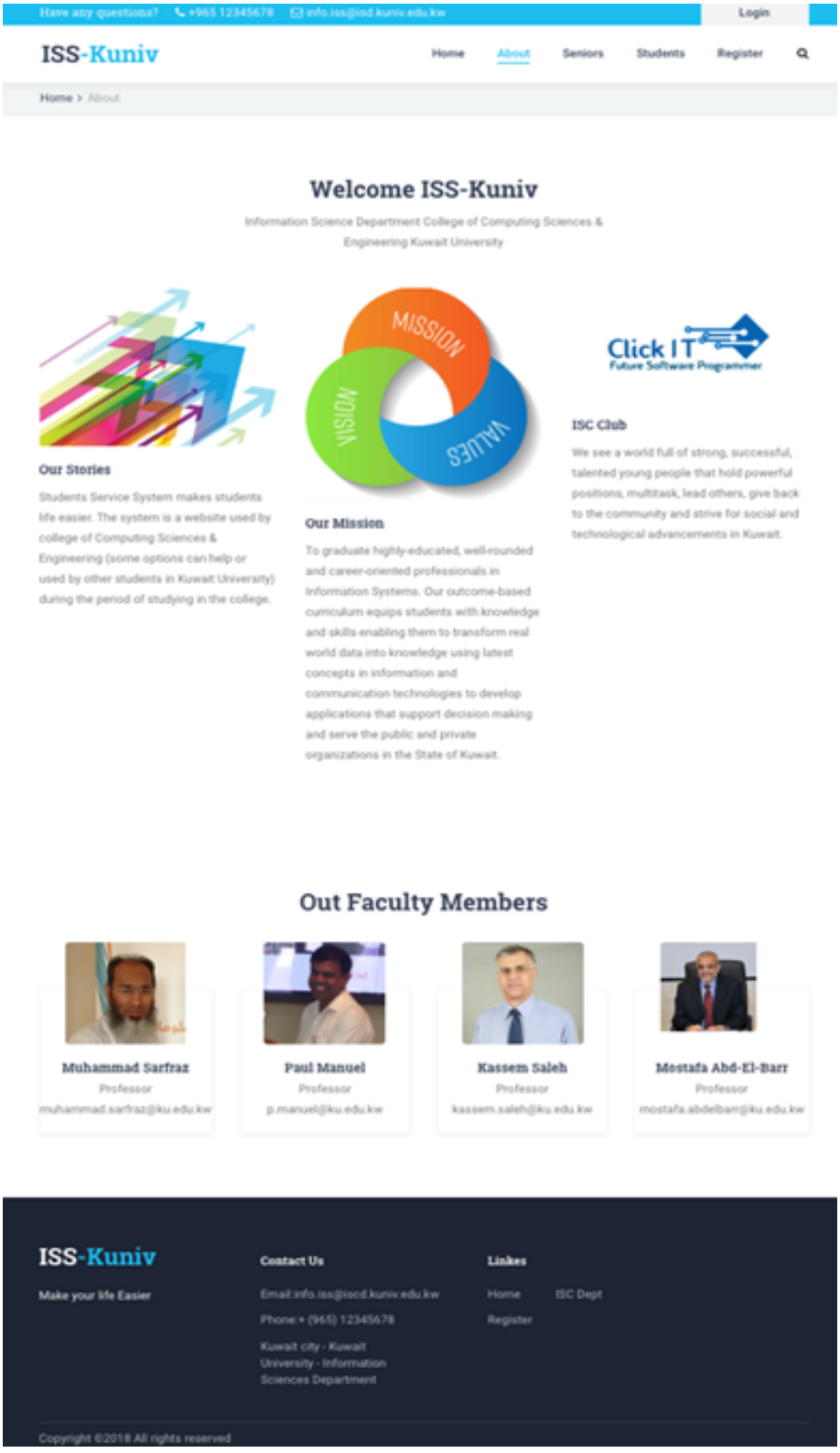
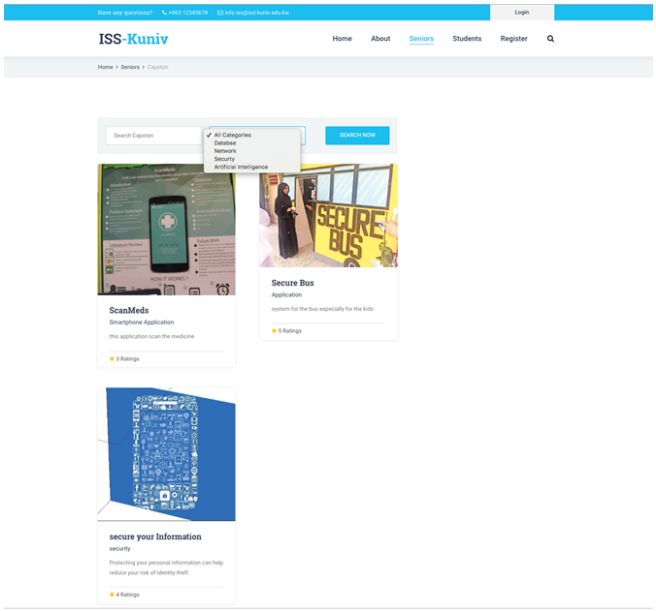
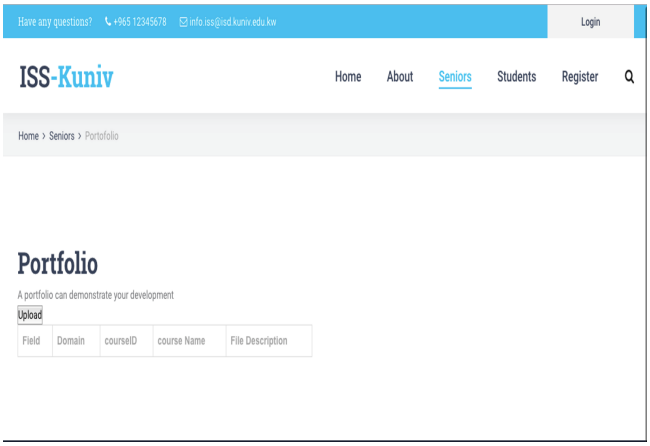


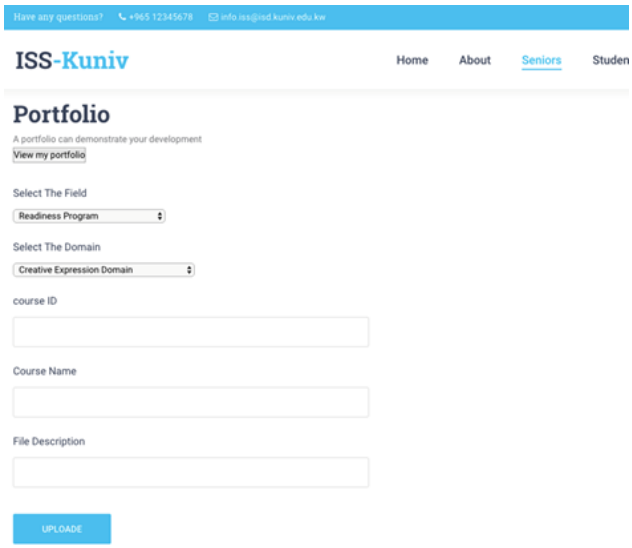
Figure 7. Demonstration of screenshot of the system on “About us” page.



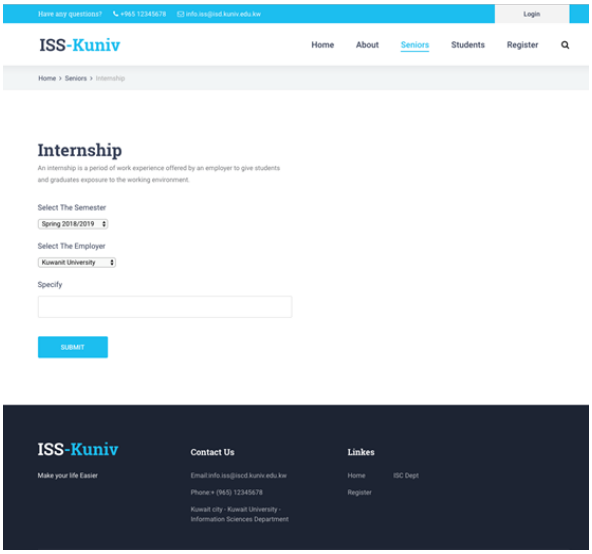
(a) Screen shot showing the system page for "Capstone Projects".



(b) Screen shot showing the system page for "View uploaded Portfolio materials".



(c) Screen shot showing the system page for "Upload portfolio materials".



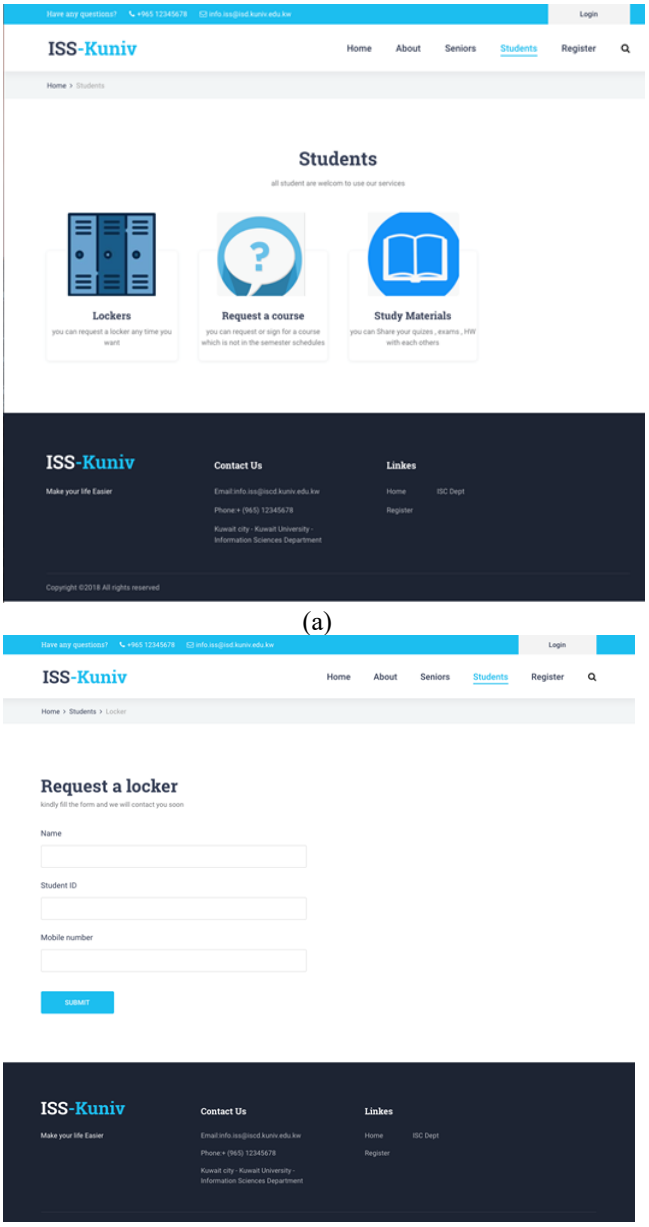
(d) Screen shot showing the system page for "Internship".

Figure 8. Demonstration of another set of screenshots of the system.

Capstone Project Page can be visited as shown in Figure 8(a). At this page, the students will be able to search graduate student project/capstone with brief description about each idea which can help them to decide what topic they would like to work on.

Portfolio Page can be visited in Figure 8(b) and Figure 8(c). Students can use this page to save their achievements in College. Thus, they can use it efficiently as their Portfolio course progresses.

Figure 8(d) shows the Internship Page. On the Internship page, a list of employers is provided for each student to select the one that is of interest to the students. The student can request an employer for train by filling an electronic from. This page also provides a facility to make a request for a new employer which is not already available at this page.



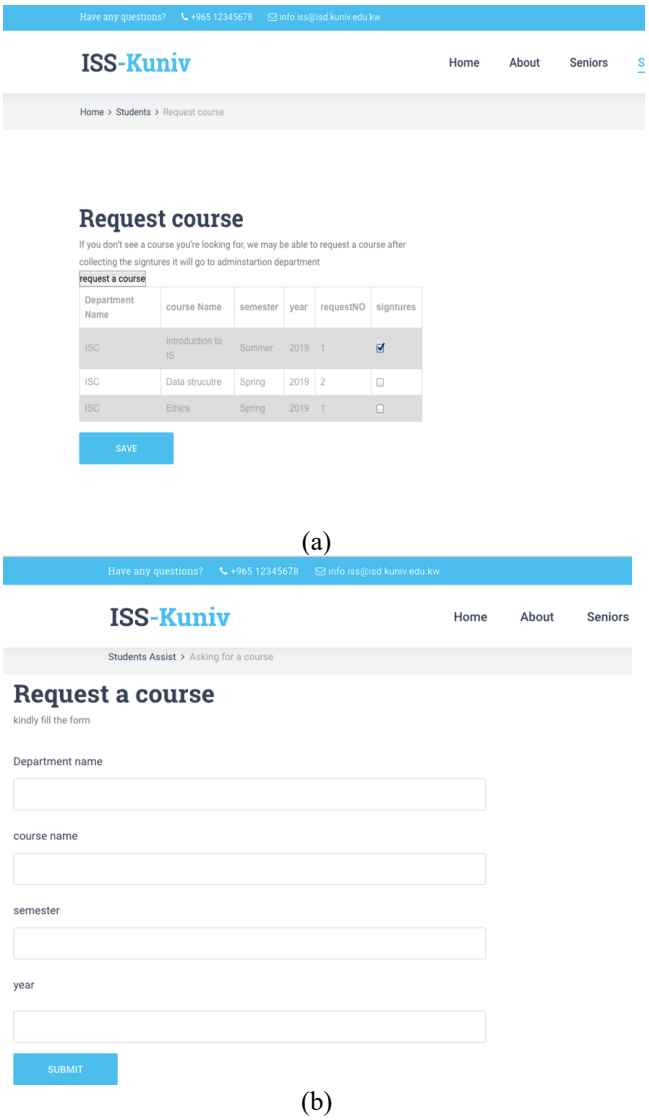
(a)

(b)

Figure 9. Demonstration of set of screenshots of the system for (a) Students, (b) Lockers.

Figure 9(a) displays the Student Page. This page will serve all users with the important services such as lockers, requesting a course, and study materials. Figure 9(b) displays the Lockers Page. By using this page, students can send a request for obtaining a Lockers. This page would require the students to fill a form to be electronically submitted to Student Union. After the form is submitted, a member of Student Union will contact the form submitter for allocation of the locker.

A request for a course is also facilitated in this system. Such a request can be submitted using the "Request Course Page" in Figure 10(a). Or if the course not listed, user can request a course in as shown Fig 10(b).



(a)

(b)

Figure 10. Demonstration of set of screenshots of the system for (a) Signing for requesting course, (b) Request a course.

Figures 11(a), 11(b), and 11(c) demonstrate on different aspects of reading material facility. One can ask for, available, upload, or request to study certain specific material, using screens in Figures 11(a), 11(b), and 11(c) respectively.

Figure 11(d) shows one of the very important pages on "Add Event". This page is meant to add any event on the system so that the community is well informed about the activities happening in the college. At this page, the admin can add events to be published at the front page of the system.

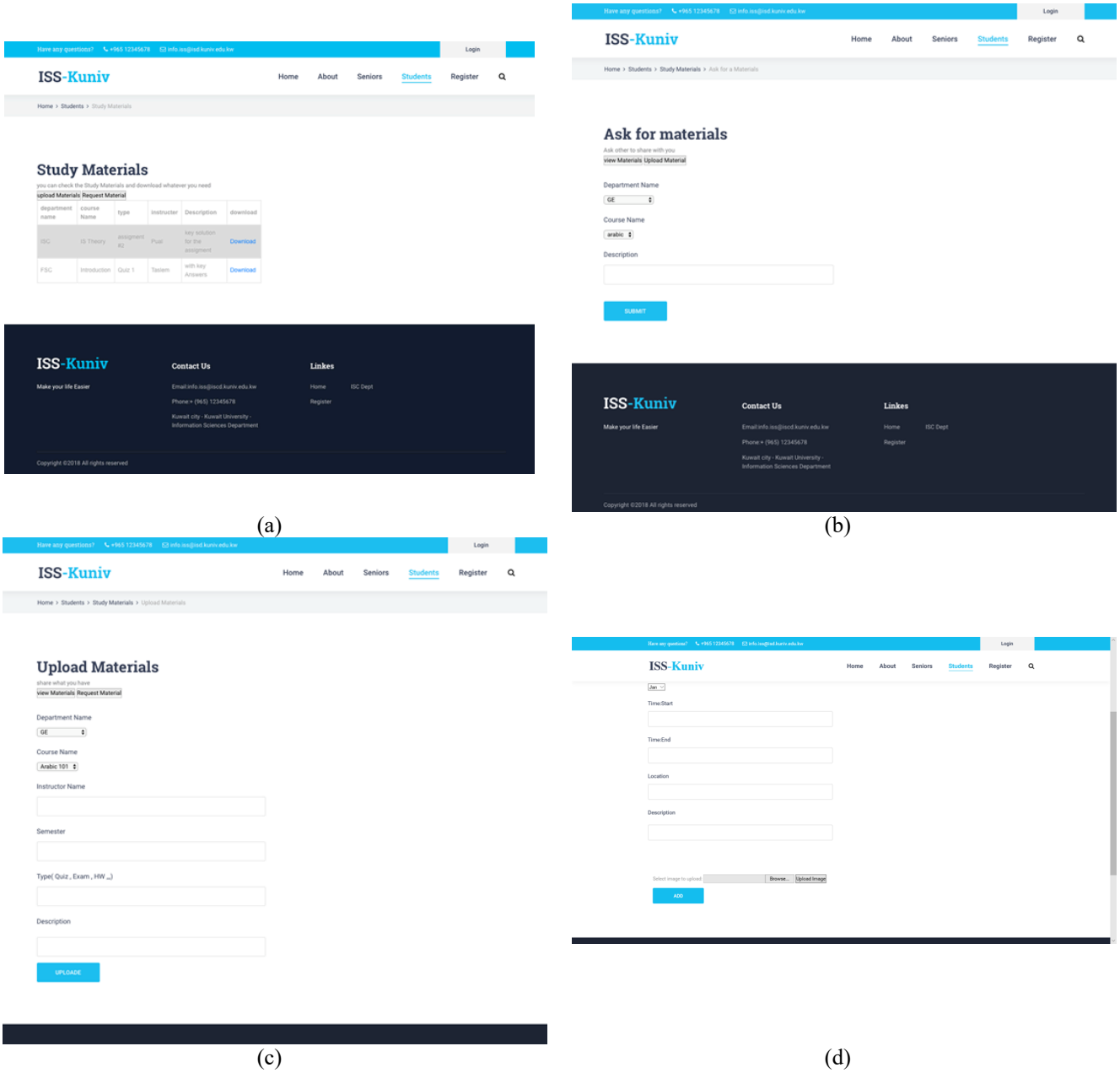


Figure 11. Demonstration of set of screenshots of the system for (a) Study Materials, (b) Ask for Materials, (c) Upload Materials, (d) Add event.

6 Conclusions

A database centric system design, for student services, in this work has been proposed and developed. It provisions the essential stakeholders including students, faculty, and student union. Based on needed requirements, it can edit, modify, and add in an automated way. The proposed system can work as a strategic tool. It provisions a mechanism to maintain benefits of the built system. It can be expanded and enhanced to incorporate more colleges, institutes and universities. Specifically, in case when the number of students, administrators, colleges and universities increase in sizes and hence the paper-based systems start to become more apparent as limitations, the benefits of such a system become even more obvious.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this article.

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