Design and Implement a Web-Based Learning System to Provide E-learning in the University of Basrah During Crises

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Abstract— In response to the COVID-19 crisis and government strategies of quarantine, bans on gatherings, or even a complete lockdown, many schools and universities transferred from traditional face-to-face learning to online remote learning. This increased the need to develop web- or mobile-based applications to support e-learning requirements. Moreover, the need for providing academic institutions with platforms that manage e-lectures and e-exams during the pandemic or any other crises like wars and disasters.

This paper provides a web-based learning system that controls course content in the University of Basrah in Iraq. The proposed e-learning system has several features, such as playing video lectures beside text lectures, providing online quizzes, and creating e-certificates. The system was developed according to the agile software development method with the Scrum technique and using HTML, CSS, PHP programming language, with MySQL for its database. In addition, the suggested e-learning system includes three authorized users: administrator, teacher, and students. Finally, an evaluation session was conducted to measure the usability and effectiveness of the system. The results showed that incorporating video lectures and e-quizzes into the e-learning system enhanced students' engagement and improved the interaction between students and teachers during the pandemic.

Keywords— e-learning, web-based learning, university of Basrah, crises, COVID-19.

I. INTRODUCTION

The sudden and rapid spread of the new disease called COVID-19 shook the entire world. On 11 March 2020, the World Health Organization (WHO) declared it a pandemic [1]. In response to the new mysterious disease and to prevent its rapid spread, several governments adopted policies, such as imposing travel restrictions, limiting the number of people being in the same place, and a complete lockdown [2]-[3] in which students were no longer able to attend schools and universities. This situation challenged the worldwide education system and compelled educators and students to switch to the online mode of teaching.

However, even before the pandemic, e-learning was playing a fundamental role in higher education. It was not exclusive to universities that are dedicated to distance education; it was largely integrated into campus-based universities [4] and considered among the best methods of education due to its extraordinary benefits and advantages [5]. Several features are associated with the adoption of e-learning systems in education; it provides flexibility where every student or learner has the option of choosing the learning time and place that suits them; institutions also have the flexibility of time and place to deliver the information; it facilitates access to an enormous amount of information, which improves knowledge effectiveness and qualifications; it reduces the cost by offering information to a huge number of learners with no need for buildings and no need to travel to obtain the information; and it allows each learner to study at their own pace, whether slowly or quickly, which makes students more satisfied and less stressed. Some students review the entire course, while others prefer to focus on certain parts. Therefore, e-learning always takes the individual learners' differences into consideration. Finally, using paperless learning promotes a carbon-free environment; thus, e-learning is an eco-friendly learning system [5]-[6]. The complete closure of learning institutions during COVID-19 highlighted a further, more significant advantage for e-learning: e-learning systems act as a panacea in a time of crisis [6].

Therefore, amidst the outbreak of COVID-19, online educational platforms, which shift the learning process from face-to-face to online, are highly requested. Such platforms should provide video conferencing and discussions with students, while increasing the accessibility of lectures, and facilitating taking assignments [7]. Some academic institutions around the world already have e-learning platforms which provide such solutions and serve more than 100 million users [8]. However, academic institutions in developing countries frequently lack such platforms to continue learning during crises [8]. In such a situation, there is a need for rapid adaption to the changing circumstances regarding preparation and working together to provide quick e-learning solutions for these academic institutions.

This research aims to develop a reliable and user-friendly web-based learning system to provide online learning in the University of Basrah during COVID-19. It allows the uploading of learning materials in the form of videos, PPT. and PDF. It also allows the teachers to add questions related to each lecture and make a quiz to examine the students' progress. Meanwhile, the students can join a course, watch lectures, take a quiz, and obtain a certificate after passing the quiz.

II. PROPOSED E-LEARNING SYSTEM

An e-learning system is defined as "the use of computer network technology, primarily over or through the internet, to deliver information and instructions to individuals" [9]. It

includes the forms of electronically supported teaching and learning like web-based training, online learning, and virtual universities and classrooms, which allow digital collaboration and technology-assisted distance learning [10]. Based on this definition, we built a web-based learning system to be a platform for the University of Basrah and provide online materials to its students during crises.

A. Target Users

The system has three authorized users, namely, administrator, teacher, and student. Each of these users has their own tasks. Firstly, the user "Admin" has authorization to manage the main system objects like courses, teachers, and students. This includes adding new objects, deleting an existing one, or approving a course that had been added by the teacher. Besides Admin, another user is the teacher; this user is permitted to manage classes, such as adding or deleting lectures, ask questions, and determine whether the course has ended or not. The student is the third user for the e-learning system. Students can enroll in any course, watch lectures, and answer questions. Fig. 1 demonstrates the system users and their tasks.
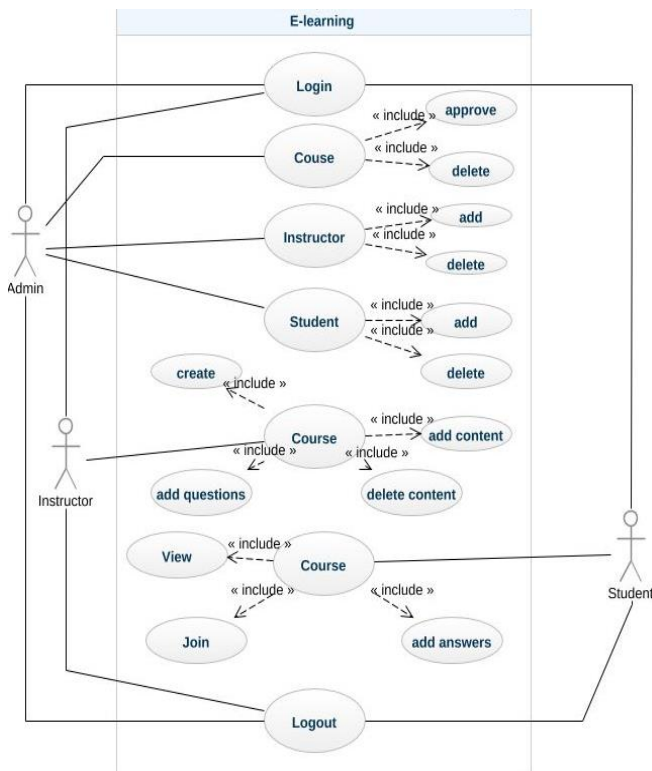

Fig. 1   The use case diagram of the proposed system.

B. System main characteristics

- Web-based system

The client-side of e-learning systems can be represented by a mobile application, desktop application, or a web-based application. Each of these representations has its own features, advantages, and disadvantages. Although the latest 2020 statistics revealed that people spend more time on mobile devices than on desktops [11], desktop applications are firmly considered as more powerful than mobile applications [12]. Engagement is the area where mobile use is lagging behind desktop use, as it was confirmed that desktop users spent 55.9% of the time

on desktop websites compared to 40.1% of mobile users [11]. This means people are accessing the websites from mobile devices more frequently than from desktops, but they spend more time on these sites when they access them from non-mobile devices. Obviously, the implementation of the client-side by a mobile application is not as powerful as a desktop application, as the small screen of mobile devices makes it difficult and inconvenient to read and write [12]. Basically, web-applications are very similar to the desktop applications, but while desktop applications are more convenient for home usage, web applications can be easily accessed from any computer connected to the Internet. Therefore, we built a web-based e-learning system due to its features as a mobile application, as it provides more usability and effectiveness to the end users.

- Videos in the e-learning system

Teachers in the proposed system could upload different types of learning materials, such as Portable Document Format (PDF), Microsoft PowerPoint (PPT), and instructional videos. Using a combination of text and video-based lessons helps teachers reach out to their students and add a human touch to their lectures in the time of crisis [6].

Before the COVID-19 pandemic, it was suggested that it is necessary to integrate video lectures into e-learning systems [13]. Several studies proved that the use of video recordings in e-learning systems makes students more engaged and motivated, and results in higher examination scores [14]. However, during the time of COVID-19, video lectures have become crucial to maintain the learning process. Studies like [15] and [16] have confirmed that using asynchronous videos in e-learning systems has helped to maintain students' engagement and connection during the pandemic. Moreover, students in [17] found video lectures fascinating, as they can watch the video several times, and pause and take notes when necessary. Therefore, in order to provide students with effective and efficient online learning approaches, the proposed system presents the lectures in video format beside the text format (PDF and PPT).

Fig. 2   Video lecture in the proposed system.

- E-quizzes and Feedback

The presence of questions in e-learning systems can enhance learning and increase the effectiveness of online video lectures. Several studies recommend

integrating e-quizzes with the content of the e-learning system. A study by [18] showed that 60% of students agreed that answering short questions after viewing a pre-recorded video lecture is beneficial in an Internet e-learning-based system. Additionally, [19] indicated that interpolating video lectures with short-answer quizzes significantly enhances students' ability to solve problems. Other researchers unanimously agreed that online quizzes motivate students to collaborate and compete with each other, and help in getting immediate feedback from learners [20].

III. METHODOLOGY

Agile is the method used to develop the current e-learning system. The process of this approach is usually based on the iterative and incremental delivery of requirements throughout the software life cycle [21]. Each iteration includes phases of planning, analysis, design, implementation, and evaluation. The Scrum technique is utilized in the implementation phase when the system development has reached the point of making and evaluating decisions [22].

The first step in developing this e-learning system was to gather the relevant information. We conducted several semi-structured interviews with the three main system users, namely, teachers, students, and administrators, to figure out what features and tasks are needed. Moreover, we conducted observations of existing e-learning systems and compared them with what was needed in the development of our system. After analyzing the qualitative data from the interviews and observations, we identified 24 requirements that needed to be added to the website.

For this project, we determined three sprints of 1 month each, one for 8 mini projects out of 24. The tasks necessary to develop the e-learning system for each sub-project were clustered into one of the three sprints. The process started when lecturers built a product backlog that represents a series of documents describing their requirements. The time for each sprint (planning phase) was estimated using a Gantt Chart. Based on the time estimated for the planning phase and after completion of the design phase, the developers organized meetings and selected the requirements that would be developed in the sprint. In addition, during the development cycle and based on the validation meetings, some of the requirements could be adjusted until all the sprints were finalized and validated. Fig. 3 illustrates the e-learning method diagram.
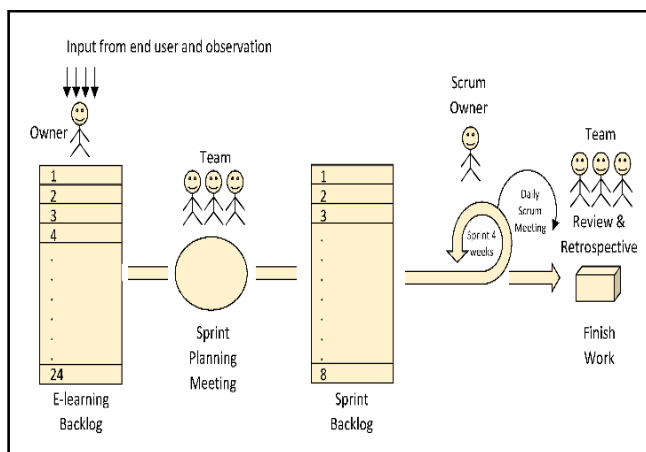
Another feature of the Scrum method is to develop "Task Board", the board which is used to monitor a sprint by showing the work to be done, the work in progress, and the completed work. Based on the task board description given by [22], we gave each of the project's requirements a code in the form of (AA-BB). AA represents the type of the requirement (F for Functional, N for Non-functional), while BB refers to the number of the requirements. When the sprint started, the first part of the task board was filled with the tasks to be done. Then, during the development process, these tasks were moved to the second part of the task board. Once the task was completed, it was moved to third part of the board, which is "completed work". In addition, in this project, each task had some details like Type: description of the task (requirement), such as uploading video lectures, answering questions by students; Code: description of the requirement to be developed; Start and Finish: dates on which the task was begun and ended; and Responsibility: name of the person who is doing the task. In some cases, one task could have more than one responsible person, as the tasks involved different skills, like designing, programming, and testing.

Finally, at the end of each sprint, the development team gathered feedback and set up a meeting to identify the potential modifications that could be adopted in the next sprint.

IV. IMPLEMENTATION OF THE E-LEARNING SYSTEM

In this stage, the theoretical design is turned into an efficient, effective working system. The proposed e-learning system was implemented using the tools HTML, CSS, PHP, and MySql.

A. System flow

The main process flow of the e-learning system is as follows: firstly, when the user tries to enter the system, the login verification checks whether he/she is a registered user and has an activated account; if not, the system asks the user to create a new account and then log in. After the user has successfully logged in, the system determines the user's identity (administrator, teacher, or student). Then according to the account details, the system transfers the user to his/her model where they are able to use the system within the limit of their authorizations. Fig. 4 demonstrates the system flow.
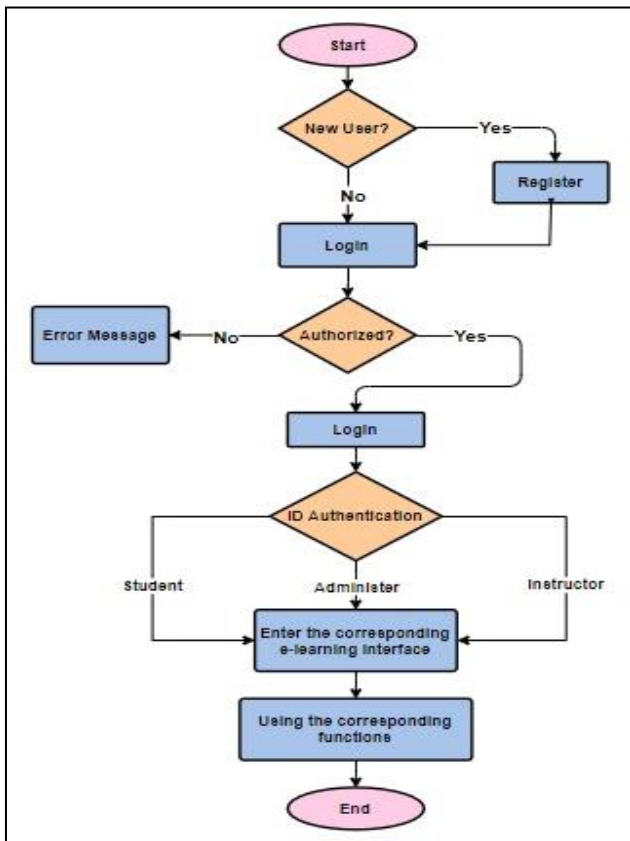

Fig. 3   Research method diagram.

Fig. 4   The e-learning system flow.

B. System interface

The system consists of three models: administrator, teacher, and student. These models are integrated to work seamlessly together as one system. Once the user opens the system, the "Home Page" will display. This page contains the title of available courses and the user window where the user can log in to the system or register as a new user. After the user login, the web-based learning platform presents the corresponding web page according to the account identity. The system's three models are explained below:

- *Administrator model*
  The administrator is responsible for managing the courses of the e-learning website. The administrator model contains all the system courses with the ability to approve or delete courses. He/she also can display the course content, delete lectures, and delete questions. In addition, the administrator is the person who creates course categories. Fig. 5 shows the page of the system administrator where they can manage courses and students.

Fig. 5   The administrator model.

- *Teacher model*
  This model is dedicated to teachers and gives them the ability to manage classes. Here the teacher can create new courses, add or delete lectures, and add or delete questions. When the teacher creates a new course, the system will ask for some information about the course, such as course title, date of publishing, and the number of hours required to complete the course. Then the teacher can add different format lectures (PDF, PPT, videos) to the created course. Finally, the teacher can add a question by pressing "add question" and can then add answers to these questions to specify the correct answers. The teacher model is shown in Fig. 6.

Fig. 6   Shows the teacher model with courses.

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Fig. 7   shows the student model with courses.

V.   DISCUSSION AND EVALUATION

This paper aimed to design and implement an e-learning web-based system. The system enables its users to access different formats of learning materials (text and videos) and do e-exams via the e-learning platform. This section explains the target users' (teachers and students) perceptions of the system.

To evaluate the effectiveness and study the user experience with the proposed system, 20 teachers and 50 students from the University of Basrah were recruited. Of the 20 teachers, 5 were from the College of Science, 10 were from the Computer Science and Information Technology department, and 5 were from the College of Art. Of the 50 students, 20 were from the College of Science, 20 from the Computer Science and Information Technology department, and 10 from the College of Art. TABLE I shows *demographic* information about the *participants*.

TABLE I   PARTICIPANTS' DEMOGRAPHICS

College	Number of teachers	Number of Students
College of Science	5	20
Computer Science & Information Technology	10	20
College of Art	5	10
Total	20	50

Since the e-learning system was developed using the agile software development process, the Think Aloud method was used to evaluate the system. According to Nielsen, "Thinking aloud is particularly suited for Agile projects" [23]. The evaluation session started with giving tasks to the users to be done on the system. Teachers were asked to use the system. This included register, log in, upload lectures, and add questions. In addition, students were asked to register, and then log in to the system. After logging in, they were asked to view the courses, join one, view the lectures, then give an answer to the questions provided.

During each evaluation session, the comments of the teacher and the students were collected. These comments were analyzed to address how these participants perceived the learning and teaching experience using the e-learning website.

Overall, students liked the idea of having an e-learning website for their university. Most of the students (39 out of 50) expressed their satisfaction with using the proposed e-learning website. They were fascinated by having video lectures on the e-learning website. Students agreed that these videos were more reliable and could save them a lot of time. They explained that instead of wasting time searching on websites like YouTube to find the target video, which might be published by an anonymous person, the suggested website contains videos that are directly structured around their modules and uploaded by their teachers. Moreover, students agreed with [17], as they found video lectures offer flexibility in that they can be watched anytime and anywhere with students being able to watch the same video several times. However, 11 students were dissatisfied, as they felt less engaged with some of the video lectures that lasted longer than 20 minutes, which they felt was too long. The same issue was identified by [24], as the authors recommended that instructional videos should not exceed 6 minutes to keep students' attention and engagement. Another study confirmed that students will not watch a video lecture for more than 15 minutes [25]. Therefore, it is recommended that video lectures be trimmed into mini lectures [25]. In the proposed e-learning system, the administrator is responsible for supervising the course content. He/she has the authority to display the course content and delete lectures if they are not in the range time of 6-15 minutes which was recommended by experts.

In terms of providing short quizzes, students indicated their satisfaction with the e-assessment offered by the proposed e-learning system. Most agreed that answering questions after each lecture is a good practice and summative activity for them. Moreover, during the evaluation session, we observed that students were more engaged in lectures which are followed by e-quizzes than with other lectures. These findings are aligned with the results from [19] and [26], as all agreed that embedding questions in video lectures affected students' engagement, learning, and presence in a positive way.

Not only students, but teachers experienced the e-learning website and gave their opinion on it. They enjoyed using the system and admired the simplicity and usability of its interface. The teachers indicated that the system would be easy to use even by individuals who are not skilled in and do not have wide knowledge of using PCs. However, computer skills from both students and teachers are required to successfully implement the e-learning system [27]-[28]. The proposed system provides good practice for teachers and students to earn new digital knowledge, as the teachers found the system gave them an opportunity to teach and learn. They mentioned that using the e-learning system could improve their technological skills, which are needed to provide knowledge through the online environment. Additionally, during the evaluation session, we observed promising improvements in the technological skills of both teachers and students.

VI.   CONCLUSION

In this paper, a web-based learning system was developed to support and manage e-learning in the University of Basrah during the time of COVID-19. Although there are several platforms and websites that provide education, knowledge, and skills, they give only general knowledge and do not provide trustworthy materials from the student viewpoint. Therefore, in this paper, a web-based learning system was developed to serve and help University of Basrah students with their learning during the pandemic.

The requirements of the e-learning system were specified, and it was developed using HTML, CSS, PHP, and MySQL.

The system provides lectures, which are structured around and specified to certain university topics, in different formats, like text and videos. It also allows students to do an e-quiz after the lectures. The results from the evaluation session showed that incorporating video lectures and e-quizzes into the e-learning system enhanced students' engagement and offered a form of interaction between students and teachers during the pandemic.

Further improvements could be added to the current system, like real-time interaction between students and teachers by using webinars (web based seminar), which would allow teachers to deliver live lectures and hold discussions in real time.

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