DEVELOPING AND IMPLEMENTING A BARCODE BASED STUDENT ATTENDANCE SYSTEM

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Abstract - *In view of the importance of students' attendance at lectures and their impact on their academic achievement, universities take the necessary measures to reduce excessive absenteeism. This is a highly important problem. The administration requires careful follow-up, taking care of it and not being lenient. At present, attendance and absence at the universities are recorded by calling the names of the students or by signing the student's attendance paper. In the process of admitting students into an examination hall in most KSA universities, 85% of attendance must be met and also considered for grade computation, therefore there is a huge need for monitoring and recording students' attendance. The aim of this work is to design and implement a barcode based student attendance system that can be easily accessed by the lecturers, to help them to avoid maintaining the registry book, providing valuable information about the students and the reports can be generated using real-time processing. The proposed work was designed and implemented using the Unified Modeling Language (UML), Microsoft Access 2007 and ASP.NET programming language.*

*Key Words***: Attendance Management, Barcode Scanner, Unified Modeling Language.*

1. INTRODUCTION

It is well known fact that virtually all organizations whether educational or commercial need to properly record the attendance of its students or employees for effective planning, management and functioning of the organization. In most universities in the developing countries, student's attendance is usually taken by old file system approach by calling students name and using paper sheets, this approach is being used for a long time [1, 2]. According to Tabassam, et al., in [3] It becomes difficult for the administration at the universities to regularly update the attendance record and manually calculate the percentage of classes absented and attended for the purpose of subsequent results processing and examinations. Keeping these issues in mind, this work designed and implemented a system to overcome the problems associated with attendance recording.

Andrew in [4] claimed that many universities are beginning to update their standards by issuing students with identification cards that are equipped with ID chips, radio frequency identification (RFID) tags and barcodes, and this is opens up the way to design and implement a barcode based student attendance system as a management in the classrooms in order to solve many problems faced by lecturers and students such as recoding security and inefficiency of traditional methods of attendance record keeping.

The technological revolution influenced everything [5-21], even the methods of marketing, business and educational applications for the real world business issues. Today, the use of Artificial Intelligence (AI) algorithms is expansive, particularly in providing solution to challenging problems including image segmentation [22-31], analysis of medical image [32-36], nurse rostering problem [37], healthcare monitoring system [38, 39], patterns recognition and retrieval of information [40-55], learning management system [56], as well as prediction of river flow [57-59]. Accordingly, utilizing the AI algorithms and web technology, countless scholars have created as well as implemented a smart attendance system to solve the student's attendance problems [60-62].

A Smart attendance system based on face recognition was introduced by Chauhan et al., [60], the proposed system can be used to take attendance of the students sitting in a classroom all at once. The proposed system involves four steps. Firstly, face detection. Secondly, face alignment. Thirdly, face encoding. Each face is encoded with unique 128 values. Finally, SVM classifier is trained with these 128 dimension values for each face. The system also makes a report of attendance with the date and then it is automatically mailed to the faculty.

Rahman et al., [63] designed a student attendance system which can efficiently manage students attendance of the Computer Science and Engineering department at Jatiya Kabi Kazi Nazrul Islam University. Fingerprint features are considered to be the best and fastest method for biometric identification. In their work, attendance is marked after student's biometric identification. For student identification, a fingerprint recognition based identification system was used. The proposed system based on fingerprint recognition was tested on a class of student fingerprint databases and achieved significant results.

Pradeepa and Kumar in [61] propose the utilization and plan of a face detection and recognition framework to consequently recognize students. This proposed facial biometric framework will contain an enrollment procedure in which the remarkable features of people's face will be put away in a database and after that the procedures of distinguishing proof and verification.

The reset of the paper is organized as follows; problem statement will be described in section 2, methodology of the proposed work will be illustrated in section 3. Database construction and testing will be illustrated in section 4. Interface design will be illustrated in section 5. Results will be discussed in section 6. Finally, the conclusion is presented in section 7.

2. PROBLEM STATEMENT

Through our observation of the current system we found many problems, including the lack of accuracy of the traditional attendance systems and the possibility of students to record their colleagues present while they are absent, and the loss of time to call the names of students to take attendance, and the difficulty of procedures to collect excuses of absence, and to raise excuses, The following questions:

1. What benefits can be achieved by applying electronic attendance to students in universities?

2. What is the impact of using the electronic attendance application on the educational process of the students?

3. What are the results to be achieved through the application of electronic attendance in universities?

4. How can faculty members and students accept the method of applying electronic attendance?

3. Methodology

The process of system analysis aims to study an existing system to entirely design a new system. System analysis is performed to achieve mainly two aims namely:

1   To understand the process or the system clearly. This will assist in the new system design.

2   System analysis will help to identify the problems in the existing system; therefore this will help to know the inefficiency reasons.

The Unified Modeling Language (UML) is visualization for the system design, it represents graphical notations which help to describe and design software systems, principally software systems constructed utilizing the object-oriented style [64-68]. The UML was utilized mainly to design the proposed system. The Use-Case diagram and the Class diagram are addressed below.

1.1 Use Case Diagram

A use case diagram is a graphic depiction of the interactions among the elements of a system. A use case is a methodology used in system analysis to identify, clarify, and organize system requirements. In this context, the term "system" refers to something being developed or operated, such as a mail-order product sales and service website. Use case diagrams are employed in UML (Unified Modeling Language), a standard notation for the modeling of real-world objects and systems [69-72]. In this case the actors are the Admin, Teacher and Student. Figure 1 shows the use case diagram for the proposed system.
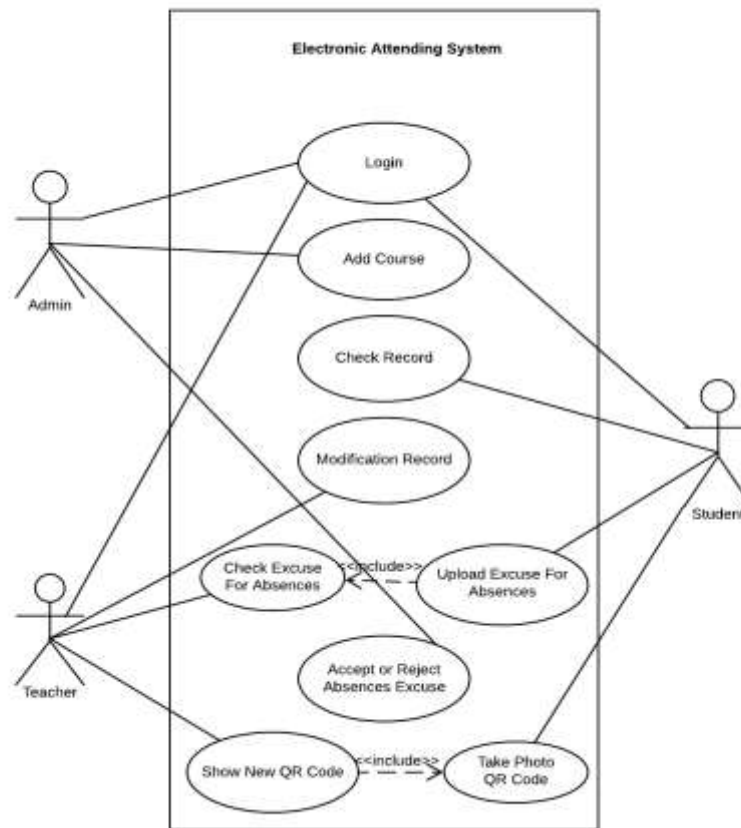
Figure 1: Use case diagram for the proposed system.

The use case starts when the user selects to login in the system and the user has to enter the information required. If the information is found correct by the system search in the database, it displays to the user the system homepage and allows the user to use the system. However, if not valid, the user will be redirected to the login page. Following is the description of the use case diagram.

- **Manager's use cases:**

1 Add Course: The system administrator can add new courses.

2 Accept or Reject Absences Excuse: The system administrator can accept or reject the excuse entered to the system by students.

- **Use case of the teacher:**

1 Login: The teacher can log on to the system with a user name and password.

2 Modification Record: The teacher can modify the student records of attendance and absence.

3 Check Excuse for Absences: The teacher can see the student's excuses for absence that have been accepted by the principal.

4 Show New QR Code: The teacher can display a new QR code for students.

- **Student Use Cases:**

1 Login: Students can log on to the system with a user name and password.

2 Check Record: Students can see attendance and absence.

3 Upload Excuse For Absences: Students can provide excuse for absence through the system.

4 Take Photo QR Code: Students can shoot QR code for recording attendance.

1.2 Context Diagram

The Context Diagram (CD) is used to establish the boundaries and context of the system to be modeled; where things outside and inside of the system are being modelled, and the relationship of these external entities with the system is also demonstrated. CD sometimes is called a level 0 data-flow diagram, it is drawn in order to clarify and define the boundaries of the software system. It identifies the information flow between the external entities and system [73]. Figure 2 shows the Context Diagram for the proposed system.
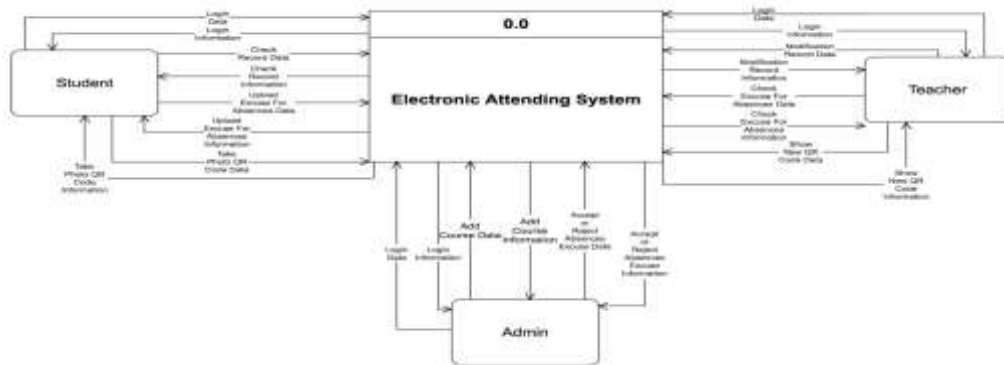

Figure 2: The Context Diagram for the proposed system.

1.3 Entity Relationship (ER) Diagram

The ER Diagram, a kind of flowchart demonstrates the way that entities such as concepts, objects, or people are related within a system to each other. ER Diagrams are commonly utilized to debug or design relational databases in the education and research, business information systems and software engineering [65-68, 74]. The ERD of the system is involved seven entities (tables) which are Student, Teacher, Student-courses, Teacher-courses, Attendance record, courses and absences and excuses.
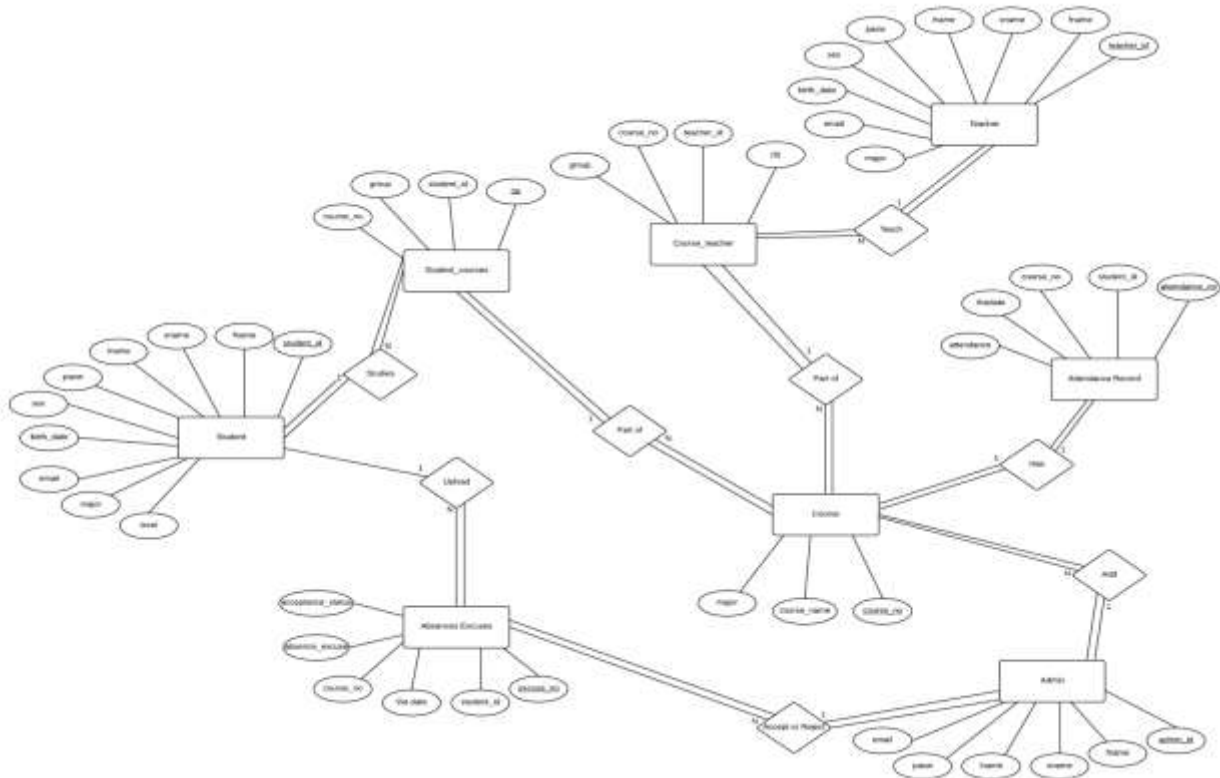

Figure 4: ER diagram for the proposed system.

1.4 Database Testing and Construction

Testing the database is important in order to find errors which might affect the system reliability, consistency, performance and security. Database testing involves the retrieval of information from the database by the desktop application or web. It assists to validate the system against the requirements specified by the user [75, 76]. Data in the user interface should be matched as per the records are stored in the database. The proposed system used Microsoft Access 2007 to implement the database. Several tables have been created as following:

Table -1: Teachers table

teacher_id	fName	sName	lName	pasw	sex	birth_date	email	major
101	Nora	Ali	Saleh	nora101	female	1/5/1991	nora@gmail.cc	FIN
102	Ahmed	Mohammed	Ebrahim	ahmed102	male	12/7/1987	ahmed@hotm	FIN
103	Huda	Abdulaziz	Saleh	huda103	female	23/1/1988	huda@hotmai	FIN
104	Mohammed	Ali	Mohammed	mohammed10	male	28/8/1989	mohammed@	FIN
105	Yara	Salem	Nasser	yara105	female	10/3/1990	yara@hotmail.	Management
106	Hamad	Abdulrahman	Yasser	hamad106	male	5/6/1977	hamad@hotm	MIS
107	Asmaa	Sami	Abdullah	asmaa107	female	19/10/1982	asmaa@hotm:	MIS
108	Saad	Fahad	Salman	saad108	male	29/11/1981	saad@hotmail	MIS
109	Jawharah	Aamir	Mohammed	jawharah109	female	9/1/1774	jawharah@hot	MIS
110	Majed	Abdulkareem	Faisal	majed110	male	18/11/1993	majed@hotm:	MIS
111	Afnan	Basem	Ali	afnan111	female	21/4/1978	afnan@hotma	Accounting
112	Bassam	Sulaiman	Saleh	bassam112	male	3/6/1980	bassam@hotn	Accounting

Table -2: Students table

student_id	fName	sName	lName	pasw	sex	birth_date	email	major	level
5001	Mona	Ahmed	Ali	mona5001	female	3/8/1994	mona@hotma	MIS	8
5002	Sara	Saleh	Khalid	sara5002	female	21/2/1996	sara@hotmail.	Accounting	8
5003	Manal	Omar	Ebrahim	manal5003	female	15/7/1994	manal@hotm:	FIN	8
5004	Nora	Khalid	Mohammed	nora5004	female	6/6/1995	nora@hotmail	MIS	8
5005	Reem	Abdullah	Ali	reem5005	female	2/2/1996	reem@hotmai	FIN	8
5006	Rania	Salem	Mohammed	rania5006	female	10/3/1998	rania@hotma	Accounting	7
5007	Samira	Ahmed	Abdullah	samira5007	female	3/5/1999	samira@hotm:	Accounting	7
5008	Amal	Mohammed	Waleed	amal5008	female	3/8/1997	amal@hotmai	Accounting	8
5009	Maha	Faris	Assem	maha5009	female	1/12/1997	maha@hotma	FIN	8
5010	Najla	Samir	Khalid	najla5010	female	11/7/1996	najla@hotmail	FIN	7
5011	Amira	Ali	Abdulrahman	amira5011	female	21/1/1999	amira@hotma	Management	8

Table -3: Courses table

course_no	course_name	major
ACCT101	Financial Accounting	Accounting
ACCT241	Accounting Information Systems	Accounting
ACCT373	Government Accounting	Accounting
ACCT412	Computer Applications In Accounting	Accounting
ACCT431	International Accounting	Accounting
FIN313	Banks And Islamic Finance	FIN
FIN321	Management Of Banks	FIN
FIN331	Investment	FIN
FIN361	Insurance	FIN
FIN362	Risk Management	FIN
FIN363	International Finance	FIN
FIN462	Banking Operations	FIN
MGMT203	Oraganizational Behavior	Management
MGMT222	General Administration	Management
MGMT333	Administrative Leadership	Management

4. Interface Design

The programming languages utilized in this work are ASP.NET programming language. The programming language is chosen relying on the languages features which make them more suitable for this work. In the proposed system, the user starts with login interface and the user has to enter the information required as shown figure 5. If the information is found correct by the system search in the database, it displays to the user the system homepage and allows the user to make use of the proposed system. However, if it's not valid, the user will be redirected to the login page. The main interface for teacher and the excuses verification interface are represented in figures 6 and 7 respectively.
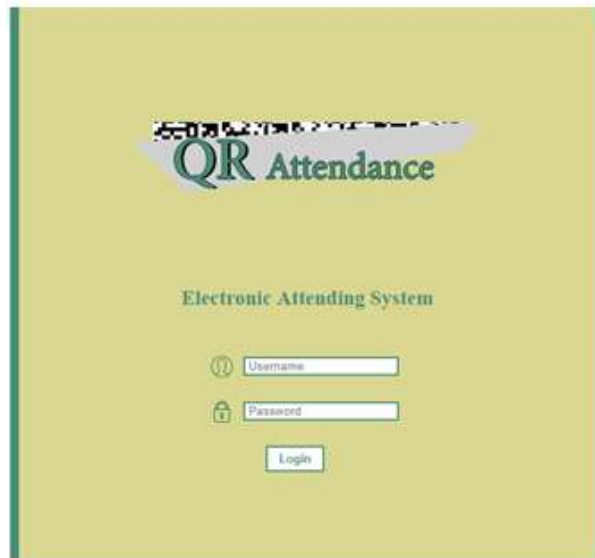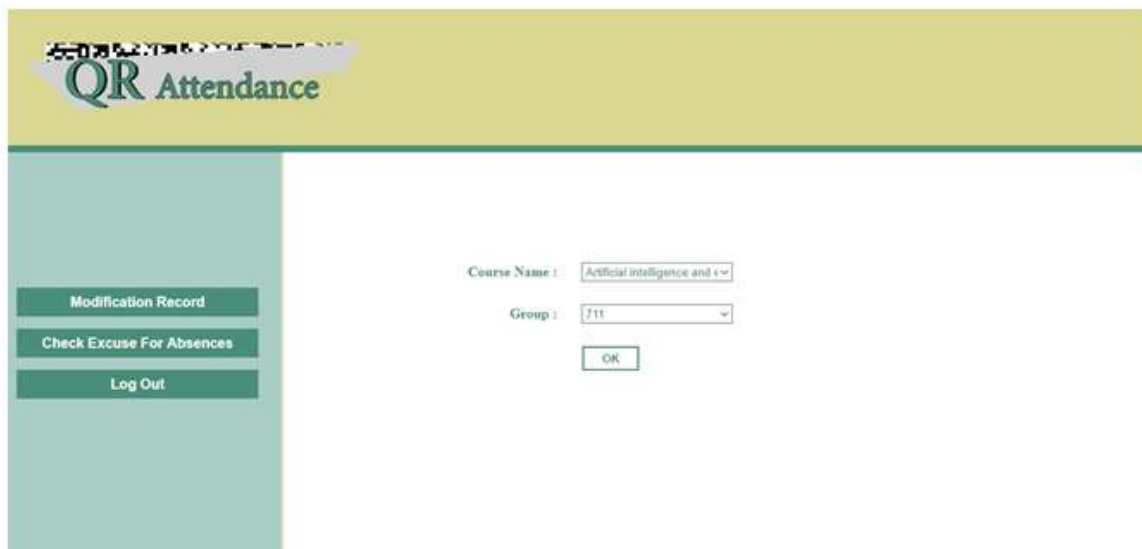

Figure -5: Log in interface

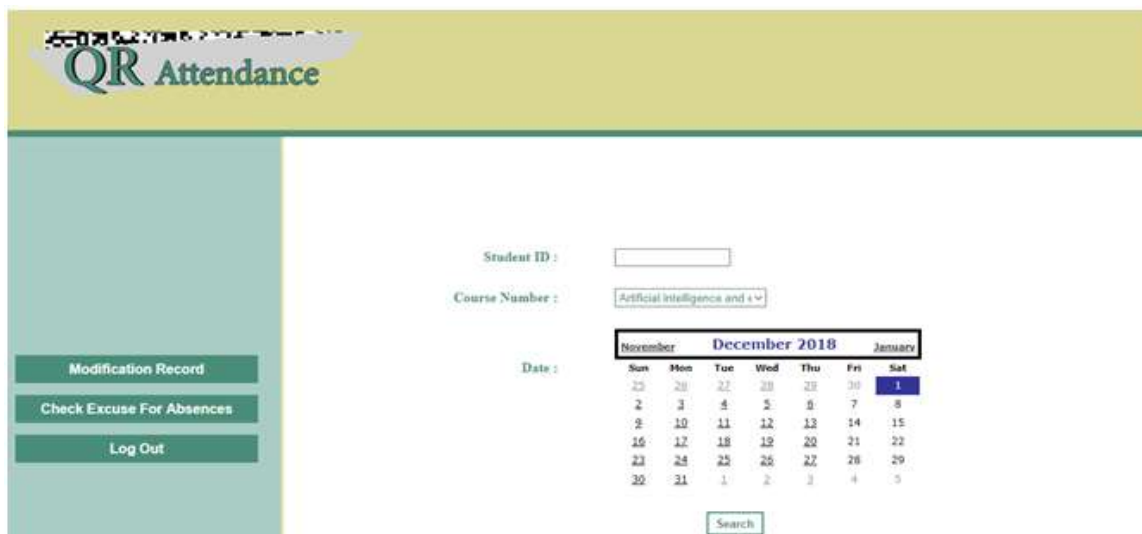**Figure -6:** The main interface for teacher

Figure -7: Excuses verification interface

5. Discussion

This stage highlights the usability of the proposed system. During this stage, the system is evaluated while user satisfaction is ensured. Test was executed on the proposed system by running it on Mozilla Firefox and Internet Explorer using the local host server. For evaluation purpose, 20 students from College of Applied Studies and Community Service at Imam Abdurrahman Bin Faisal University (IAU) were invited to use the prototype. The students were first briefed on the prototype's usage and the user interface. Then, the students tested the system, and answered a survey questionnaire consisting of 10 items formulated to gauge the level of user satisfaction. The usability of the proposed system was also determined. The result as well as the level of usability of the system according to the feedback provided by 20 students can be referred in table 4. As can be construed by the result, a significant amount of users agrees that system is practical, useful and fulfills the project's primary objective.

Table 4: collected data results from the 20 students.

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Strongly disagree										
Disagree										
Neutral	6	5	6	4	3	2	1	3	4	5
Agree	5	9	7	7	6	8	11	3	12	11
Strongly agree	9	6	7	9	11	10	8	14	4	4

6. Conclusion

Computerizing classroom attendance tracking has many advantages over the old system. Data from classrooms can easily be transformed into databases for possible later analysis or usages. This work designed and implemented a barcode based student attendance system that can be easily accessed by the lecturers, help the lecturers to avoid maintaining the registry book, providing valuable information about the students and the reports can be generated using real-time processing. The proposed system was designed and implemented using the Unified Modeling Language (UML), Microsoft Access 2007 and ASP.NET programming language. The proposed system will also help in generating the defaulters list on its own and send emails to those students whose attendance is below the required amount.

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