Towards a Smart Campus: Smart Classroom Management

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Abstract: In this research, we have developed a Smart Classrooms Management System (SCMS). The SCMS provides a comprehensive solution to classroom management through the engagement of smart devices, the Internet, and computer applications. The system consists of several components; these are classroom scheduling and access control, student attendance, and lectures management. The work has been divided into three phases; In phase one, we have developed the student attendance registration and monitoring system by using the QR Code technology. The attendance system was recorded manually. The manual process required more time, labour, and prune to human errors. The manual attendance has been replaced with automatic methods that utilizes smartphones based on QR Code technology. The work has shown promising results which made classroom management smarter and more efficient.

Keywords: Smart Campus, QR Code Technology, Internet of Things, Smart Classroom Management

I. INTRODUCTION

In this research, we have developed a Smart Classroom Management System (SCMS). The SCMS system provides a comprehensive solution to classroom management by employing smart devices, the Internet, and computer applications. The system consists of several components; these are classroom scheduling and access control, student attendance, and lectures management.

We have divided this work into three phases. In phase one, we have developed the student attendance registration and monitoring system by utilizing QR Code technology. Previously, the attendance system was recorded manually. The manual process required more time, labour, and was prune to human errors. The manual attendance process has been replaced with automatic methods that uses Smartphone based on QR Code technology. In the next section we present the background work. In section 3, we present the methodology, in section 4, we discuss the results and discussion, then we conclude with the conclusions and future work.

II. BACKGROUND

The Internet of Things (IoT) has become the next step in the evolution of the Internet. In recent years, smart cities, smart environments, and smart homes are some of the terms that are coined within this evolution. In Education, we have seen some research projects that are working on Smart University, Smart Campus, and Smart Classroom [1, 2, 3, 4 and 5]. IoT is used by some educational institutions to provide the infrastructure and physical environment to aid the teaching-learning process [6]. For example, in the creation of smart environment by monitoring and controlling air quality, temperature, and humidity [7]. In addition to ensuring higher security to their buildings and the consumption of energy like building lightening. The educational activities inside the classroom have also received attention. This is done by the utilization of smart devices such as interactive white boards, tablets, smart phones, and other computing devices connected to the cloud [8]. Several researchers have used QR Code technology with success as shown in [9, 10, and 11]. QR Code technology has also been used in the health sector to enable physicians to access the data of patients during emergency [12]. In [13], QR Code technology has been coupled with GPS technology, where student attendance is traced from the GPS location, combined with QR Code. All researchers in these projects that we have reviewed, favoured the utilization of QR Code technology for its efficiency and cost-effectiveness.

We may conclude that the work in this direction has been centred around two processes; the first one is the teaching-learning process, and the second one is the classroom management process. Most work we have reviewed is mainly

concerned with the teaching-learning process and very rarely on the classroom management process. Research in this direction is still in its infant stages, and there are many issues are still open for more work.

III. METHODOLOGY

SCMS provides a comprehensive solution to classrooms management by the employment of smart devices, Internet, and computer applications. The system consists of several components; these are classroom scheduling and access control, student attendance, and lectures management. The work has been divided into three phases. In this phase we have developed the smart student attendance system by using the QR Code technology. Previously, the attendance system has been recorded manually. This section describes the modeling of the SCMS. The main purpose of the SCMS is to maintain attendance records of the student for the course using current state-of-the-art technologies. The SCMS system involves three users: Admin, Instructor, and Student. Admin is an identity who control, manage, and run the system.

The admin functionalities are:
- Start New Semester
- Add Instructors.
- Add students.
- Add Courses.

Instructor is the person in addition to teach the course, also takes the attendance of the students, and manages absences.

Instructor functionalities are:
- Take Attendance
- Update Attendance
- Manage Absences

Student check in attendance at the beginning of the lecture. Also, they may view their attendance report.

Student functionalities are:
- Check in for attendance
- View attendance report

The use case diagram, shown in figure 1 above, describes the actions of all users in the system. These actions aggregate the functionalities of the system which will be described in detail in next section.
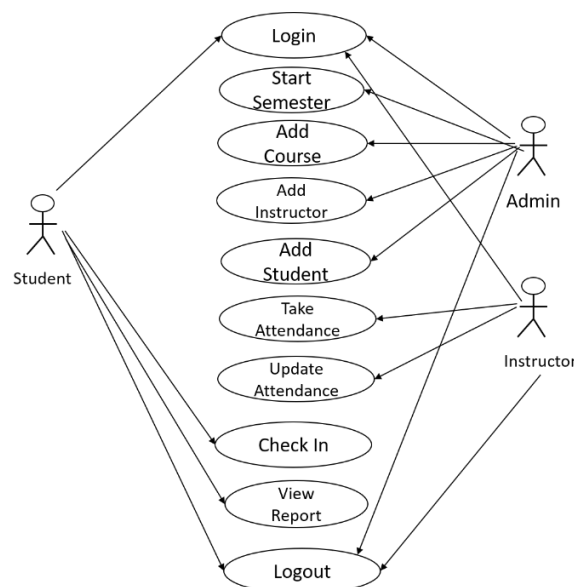

Figure 1: Use Case Diagram

The class hierarchy in figure 2 shows the three users of the systems. These are Admin, Instructor and Student. All users of the SCMS system are derived from the super class (User). Class User has the common attributes among the users of the system, which are Name, Username, and Password. Each user of the system provides a set of services as shown in Figure 2.
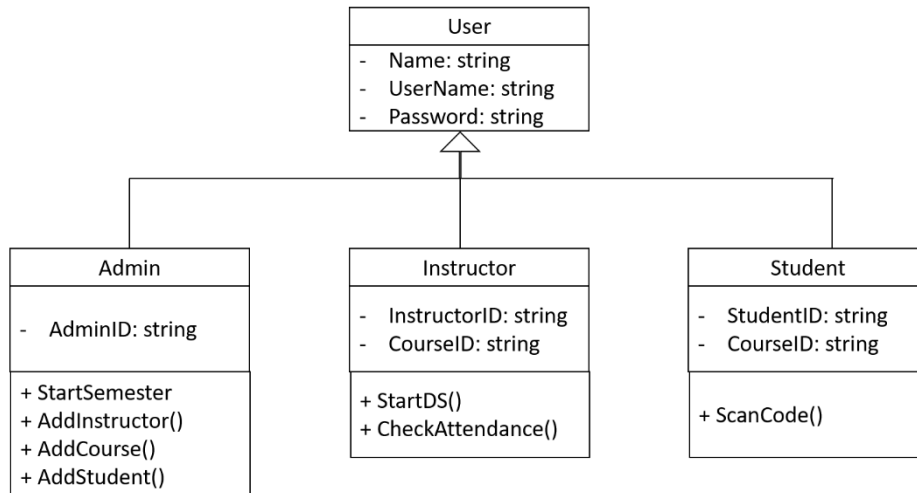

Figure 2: Class Hierarchy

Figure 3 shows the Entity-Relationship diagram for the SCMS system. This diagram shows the relationships between all entities in the database of the system. The database is where the data of the system resides. The data is divided into related tables as shown in detail in the diagram.
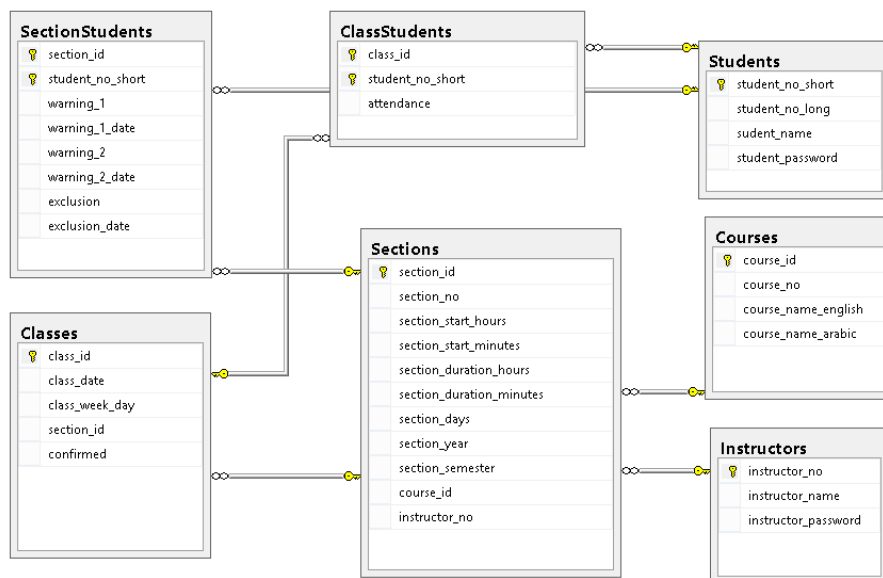

Figure 3: E-R Diagram

IV. RESULTS AND DISCUSSION

In this section, the resulted system is explained in detail. We start with the instructor section.

1.1 Instructor

1. The instructor opens the class and starts the data show

2. Instructor logins to the SCMS application as shown in figure 4.

نظام الحضور الإلكتروني

جامعة الإسراء

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تسجيل الدخول

Figure 4: Login screen for instructors

3. The instructor then chooses the course from the list of the course, he/she teaches in the current semester, as shown in figure 5.

جدول مواد عضو هيئة التدريس للفصل الحالي

برمجة متقدمة (1)

أساليب كائنية المنحى (1)

تحليل وتصميم نظم المعلومات (1)

Figure 5: List of instructor's courses

4. The instructor then displays the logo on the screen for the students, which also will be shown on the web application as shown in figure 6.

Figure 6: QR Code on web application

5. The instructor checks and confirms the attendance of all students

1.2 Student

1. Students logins by entering his/her student ID, shown as a university number, and password to the SCMS application, as shown in figure 7.

Figure 7: Student login screen

2. The student then points to the logo on the screen of the data show and registers the attendance, which is also shown in figure 6 under the registration buttons.

3. The student then exits the system.

V. CONCLUSION

The SCMS system provides a comprehensive solution to classrooms management by the employment of smart devices, Internet, and computer applications. The system has been completed and tested by the research team. The system has been deployed and currently running for two months. The results seem very encouraging. We are in the process of recommending replacing the manual system completely and proceed to the next phase.

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