Smart Attendance System using QR Code

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Abstract - In higher education institutions, student participation in the classroom is directly related to their academic performance. However, the majority of student attendance registration is still conventionally done, which is tedious and time-consuming, especially for those courses that involve large numbers of students. Over the years, attendance management has been conducted manually at most of the universities. To overcome the manual attendance issues, we proposed and implemented a smart attendance system with the aim to encourage the potential use of the Quick Response (QR) code as a future attendance management system, to track and record student attendance in lectures and exercises for all relevant courses, as an aim of this paper.

Keywords – QR Code, attendance, system, professor, student.

I. INTRODUCTION

Nowadays, it is very important to finish the job fast, learn something new, get higher results as easy and efficiently as you can. Every sector, especially in the education process and in the business world, needs management systems that will enable them to have adequate control and management in the development of learning or work. Considering all these advantages and benefits, we thought that the process of education at the university, in particular, needs an online system to manage student attendance.

Among others, regular attendance is a basic and most important criterion throughout the education system. Consequently, the student might lose the right to sit an exam if attendance criterion is not met. Moreover, if students exceed the number of allowed absences, they might also lose the right to sit final exams. Given that, the manual method which is currently used, give space for more calculation errors.

We proposed and developed a better web-based system to help overcome such issues. It is fully responsive to mobile phones, tablets and various computer systems users. The proposed model provides data security and whole class or individual student attendance data can be accessed quickly and easily, moreover, the report is automatically generated by the professor. The purpose of the internet-based attendance system is to computerize the traditional way of registering attendance and to provide an easier and smarter way to track institutions attendance nowadays, based on a unique code for each professor and student known as QR code. At the beginning of each course, to confirm their attendance, users (professors and students) are required to scan their unique QR code assigned to them during or at the beginning of each lecture, using QR reading devices within the classrooms. Based on this, the lecture and student attendance record and other necessary data will be recorded.

The system will help a lot in improving student attendance in particular courses they need to attend and will save a lot of time.

This paper consists of three sections: the first part deals with the related papers; the second part details the proposed framework; and the last part details the implementation plan according to a case study conducted at University of Tetova – North Macedonia.

II. RELATED WORKS

In early years a punch card system was used for data storage, also known as Hollerith cards, through which companies were able to store and access via entering the card into the computer system [1]. It is also commonly used nowadays as an attendance system in educational institutions. Employees wave their individual cards near a reader to punch in and out, ensuring the presence of the employee [2]. There are quite a number of previous researches in the field of computer science developed students' attendance tracking system to improve record taking in class using different technologies. For example, RFID [3] or near field communication (NFC) technology [4].

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An example of application that Jainetal has developed is a desktop application in which a list of all registered students in a particular course is displayed when the class commences. Attendance is registered by clicking off a checkbox next to student's name that are present, and then for marking their presence a register button is clicked [5].

Based on [6] authors have approached to implement the students' attendance tracking system by using QR code including google forms and google sheets which are more convenient to be adopted by lecturers with no technical and computer programming skills required.

The proposed system by authors on [7] aims to record all student participation based on the generated unique QR code of each course for each class day. The instructors, in turn, copy this QR code and paste it on the first slide to be displayed in the lecture. If the instructor policy is to allow late students in his class and would like to mark them as present or late, then the QR code should also be copied on one of the four corners of as many slides as the instructor wishes. When the students are in class, the first thing that should be done is to pull out their smartphones, open the Mobile Module, and scan the QR code, then the Server Module runs an identity check on the registered students. This is done by comparing the facial image sent per transaction with the stored image on file for the student in question, the system will then control the location of student. Finally, a location check will be performed.

Our proposed model differs in a manner that should be easy to apply and quick in recording attendance during a class session; by focusing on creating a simple student attendance tracking system that can be used to take attendance which is both fast and affordable in comparison to the other methods.

III. PROPOSED MODEL ARCHITECTURE

This section describes the various tools and techniques used in creating an online attendance system using QR code and all the operation of the system. A QR Code is a two-dimensional barcode that is readable by smartphones and allows the encoding of over 4000 characters in a two-dimensional barcode.

QR Codes may be used to display text to the user, to open a URL, save a contact to the address book or to compose text messages. "QR Code" is a registered trademark of Denso Wave Incorporated. A QR code can be read by almost all mobile phones and webcams in web browser [8].

The proposed model (Figure 1) is divided into three modules: the first module is the module of the administrators, which consists of 3 types: admin, head of study program and administrator of the study program. The role of the main Administrator is to backup the system and database, edit it, manage and insert professors, students, faculty, study programs, as well as create heads of study programs and administrators for the respective study programs. On the other hand, the head of the study program has the opportunity for the semester to make a schedule for the professors, by setting the time when the class will be held, adding departments to the respective program, and the administrator of the study program is responsible to select the courses that the respective student should attend during that semester.

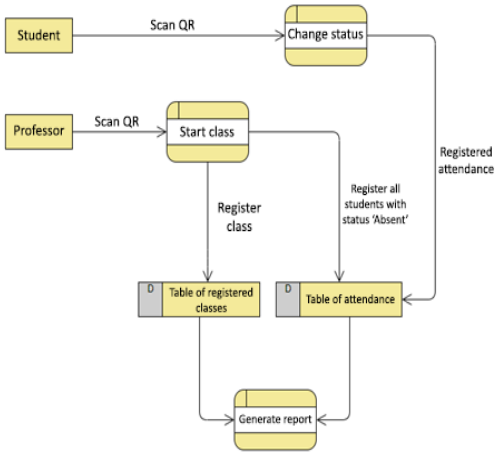


Fig 1. Proposed Model Architecture

The second module is the attendance record, which will be carried out through a device in each classroom that will be connected to a camera device and the internet. It will enable QR code reading using the Instascan JS library, the system will read the QR code which contains the unique professor or student ID. The code is initially read by the professor, which enables him to register the lecture held by the respective professor, within a specified time interval, based on the schedule inserted by the head of the study program. Then, based on the day and time interval, the system starts the class that the professor should be attending that day, and it automatically registers the class as completed and for that date inserts all students attending that course with 'Absent' status. The next page opens and the camera opens to read the QR code, but now the student has to read his code to the device. There is the whole list of students attending the course and each student reads their unique QR code in order to change their status to 'Present'. With each code reading, the system checks in the database, and depending on whether the status will change or not, whether the student is assigned the course or not, the system displays a message about the current state. And when the professor reads his QR code again the class ends successfully.

The third module is about the professors and students module, where the professor and the student can log in to the system with their data obtained from the administrator. The professor can check the consistency of the student attending the class. So, the system for each student performs the calculation

process which includes the total number of absences and number of attendances, in percent, based on the course. Therefore, the professor is able to view and read the value without calculating it manually. It can also generate monthly reports for classes held by the professor, as well as student attendance reports. The student has the opportunity to check his/her participation in all the courses by seeing how many times he/she was absent and present.

IV. SYSTEM IMPLEMENTATION

The proposed implemented system shown in this paper, consists of two main activities, *data management* and *attendance records.* The coding is accomplished by first coding small packages, then merging them into larger software packages and testing how they work together. The entire interface is designed to be responsive to all devices we use so it's clear and understandable, no matter which browser we use or devices we open it, such as PC, mobile, tablet, etc.

The main activity for the system to work is the registration of study program heads, study program administrators, professors and students. Thus, their registration gives them access to the system. The head has the option of registering the professor's schedules for the respective courses in the current semester, and the administrator has the opportunity to record the courses the student is attending that semester. After logging in each user will have a different dashboard based on what role they are logged in to.

Following is the code that control the role of logged user:

```
if (email == user_email.Value.ToString() && password ==
user_pass.Value.ToString() && role == "Admin"){
    Session["Role"] = role.ToString();
    Response.Redirect("dashboard.aspx");}

else if (email == user_email.Value.ToString() && password ==
user_pass.Value.ToString() && role == "Head"){
    Session["Role"] = role.ToString();
    Response.Redirect("Head/dashboard.aspx");}
    else if (email == user_email.Value.ToString() && password ==
user_pass.Value.ToString() && role == "Referent"){
    Session["Role"] = role.ToString();
    Response.Redirect("Referent/dashboard.aspx");}
```

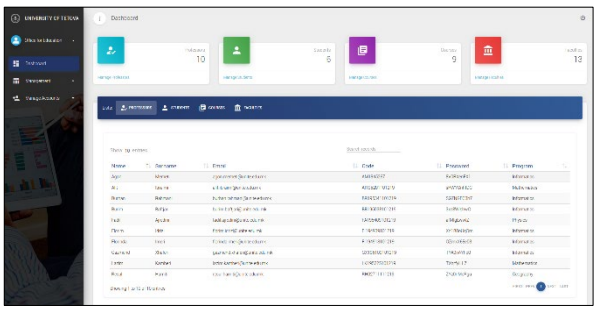


Fig 2. Dashboard interface

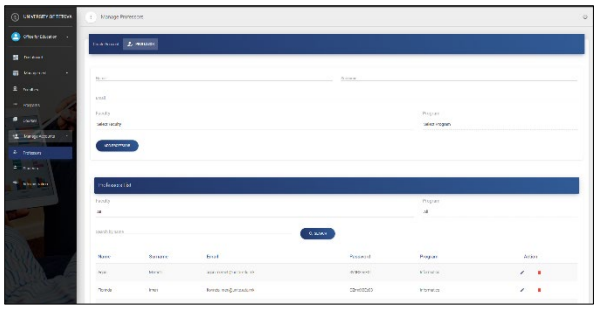


Fig 3. Example of data management interface

Generate Report is an activity for professors to generate reports based on the month and year they choose. So they have the opportunity to choose the course and for that course to generate student's report.

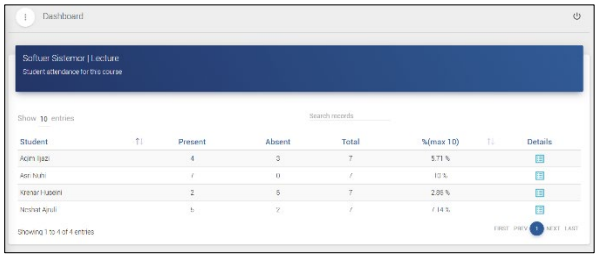
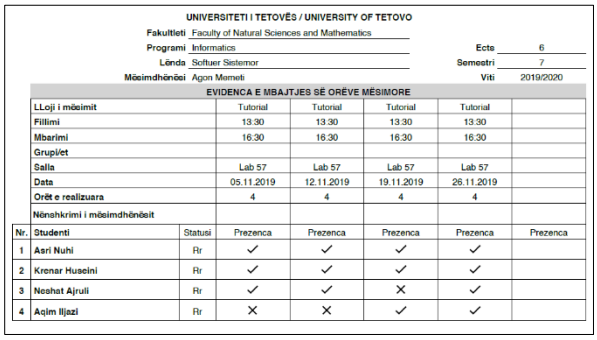


Fig 4. Student attendance for course



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Fakulteti: Faculty of Natural Sciences and Mathematics
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EVIDENCA E MBAJTJES SË ORËVE MËSIMORE

LLoji i mësimit		Tutorial	Tutorial	Tutorial	Tutorial	
Fillimi		13.30	13.30	13.30	13.30	
Mbarimi		16.30	16.30	16.30	16.30	
Grupi/et						
Salla		Lab 57	Lab 57	Lab 57	Lab 57	
Data		05.11.2019	12.11.2019	19.11.2019	26.11.2019	
Orët e realizuara		4	4	4	4	
Nënshkrimi i mësimdhënësit						
Nr.	Studenti	Statusi	Prezenca	Prezenca	Prezenca	Prezenca	Prezenca
1	Asri Nuhi	Rr	✓	✓	✓	✓	
2	Krenar Huseini	Rr	✓	✓	✓	✓	
3	Neshat Ajruli	Rr	✓	✓	×	✓	
4	Aqim Iljazi	Rr	×	×	✓	✓	

Fig 5. Generated report for chosen course

Attendance records is another main activity of this proposed system. This activity enables the professor to read his QR code, if there are courses in that day in that time interval the system will go to the next page, if not then an error message will be displayed. After the professor scans his code, the next page shows all the students attending that subject with 'Absent' status, then when the student scans the code he changes his status to 'Present'. The system also sends a warning email to students who exceed the number of absences for course attendance.

Following is the method of reading QR code value that used to record attendance.

```
let scanner = new Instascan.Scanner({ video:
document.getElementById('preview') });
scanner.addListener('scan', function (content)
```

```
{
document.getElementById('HiddenField1').value = content;
document.getElementById('<%=
MarkAttendance.ClientID%>').click();
if (content != 0) {
document.getElementById('scanCh').innerHTML = 'Read
Succesfully!';}
setTimeout(function () {
document.getElementById('scanCh').innerHTML = 'Please Scan!';},
2500);
Instascan.Camera.getCameras().then(function (cameras) {
if (cameras.length > 0) {
scanner.start(cameras[0]);}
else {
console.error('No cameras found.');}
}).catch(function (e) {
console.error(e);
});
```

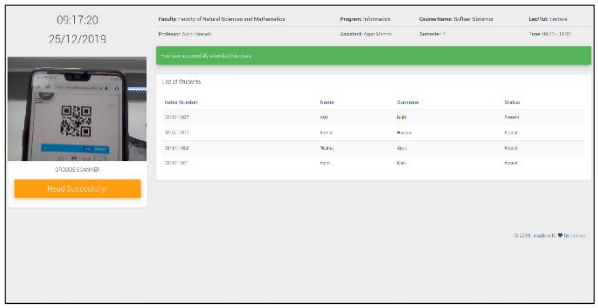

Fig 6. Course attendance record

Regarding the implementation of our system, respectively as intended for our University, it is an implementation that will replace the current system of manual monitoring and recording. So far, there has never been such a system to manage student attendance electronically at the University, and we think that implementation requires some time and dedication.

There must be a person with clear responsibility and time for the system. The first task is to do is to develop a reference document that will show all the work the system does, and based on this document to start training system users, as this will save time as everything is documented and well explained. Then for each professor and student, a card should be issued which will contain their name and a unique QR code, which will help register attendance. Then in each class, a device must be installed, which will have a camera open to read QR codes. This will do a great job towards the technological advances of our University, as is taken as a case study.

V. CONCLUSION

These days it is required to keep up with the latest technologies, especially in the field of education. Educational institutions have been looking for ways to enhance the educational process using the latest technologies. Seeing as everything moves towards digitalization, we think that this system is pretty much necessary for the University. In this paper, we have described a proposed system that incorporates QR codes and devices connected to internet in taking student attendance. This study shows that the QR code, a multi-faceted and popular feature of smart devices, can be used as an efficient method of recording attendance, replacing the old, traditional way of calling name lists in class. This system was developed after reviewing and analyzing the existing manual system and an analysis of the systems used by other Universities.

This affordable QR code-based attendance system enables lecturers to speed up the process of recording attendance, especially in a large classroom and would save them valuable teaching time. The proposed system provides better security than the traditional methods, including eliminating chances of students signing up for others who may not be present. Even though similar platforms are already developed, we believe that the proposed platform will be more attractive for several reasons: It has a great advantage, among all types of code scanning technology; the QR Code attendance system is the most accurate and efficient method of maintaining attendance in a database and controlling it from any intelligent device rather than wasting paper.

The acceptance of QR code by students and educators is critical to the successful implementation of this technology. Therefore, it is important to understand the factors that affect student and lecturer intentions to use the QR code for this purpose.

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