Implementation of the iQR smart attendance system

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Abstract: As smartphones become much more popular and preferred in the modern world, university traditional attendance marking systems can also be digitalized through smartphones. Attendance marking can be somewhat troublesome in some manner, but it is imperative in a university environment. Quick Response code-based solution is the most productive and cost-efficient alternative solution for every existing attendance marking methodologies available right now. The Quick Response code-based attendance systems' basic approach displays a Quick response code on a screen and lets students scan it using a proper device to mark their attendance. This way, the proposed methodology eliminates most of the practical issues that have to be faced in existing university attendance systems and improves productivity by automating the overall process. Particular universities or any higher educational institute can gain a significant amount of benefits through a QR-based approach as for its nature. This paper discusses existing attendance systems with their known issues, shortcomings of current QR-based practices, and the novelty of the proposed IQR Smart Attendance System with its methodology.

1 INTRODUCTION

The attendance system is critical in a university environment that plays a minor role and makes all other aspects dependent. In an average university environment, attendance marking is done for the parties of students, academic and non-academic staff members. Students' attendance for every lecture session they attend is slightly complicated and time-consuming rather than taking both academic and non-academic staff members. The proper attendance of lecture sessions, practical sessions, and tutorials are considered a semester exams' requirement. It should obstruct any loopholes that deceive the system and give the most accurate output to the administration. Manual signing sheets, smart card systems, biometric identification systems, and mobile hotspot-based attendance systems are the most common approaches implemented in universities. History has shown manual signing drawbacks such as fraud signatures, time-consuming, unorganized, and decentralized data handling [1]. Moreover, smart card systems have also proven a significant drawback of giving loopholes for swindlers to mark attendance for more than one person and cheat on the system. On the other hand, biometric identification-based attendance systems have eliminated every loophole that can be gained as an advantage to cheat on the system. Still, time consumption and ill-cost efficiency remain the same as in the traditional signing sheet methodology. When it gets too many students waiting in a queue to provide their touch identification or facial identification to mark their attendance, they will waste a considerable amount of time from the instructor [2].

The proposed methodology uses a series of Quick Response (QR) codes to get students' attendance and

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reduces the non-academic staff overhead by automating the attendance marking process. This reduces the complexity of the existing attendance systems and saves a huge amount of time and effort by giving high accuracy and security to the overall process.

2 QUICK RESPONSE CODE

A Quick Response code or QR code is a two-dimensional matrix first developed in 1994 for Japan's auto business [3]. QR codes frequently contain information for a locator, identifier, or tracker that focuses on a particular website or application. QR codes are utilized four standardized encoding modes (numeric, alphanumeric, byte/binary, and kanji) to store information proficiently; extensions may likewise be used. This has gotten mainstream outside the auto business because of its reading speed and storage capability compared to standard barcodes. A QR can consist of any information. QR code comprises dark squares arranged in a square grid on a white background, which can be perused by an image detecting device, most notably smartphones. The necessary information is then disengaged from the figure available in both QR image dimensions [4].

The QR code-based attendance system is proposed in the literature, a simple Android application for both lecturers and students. The system's methodology is to get student attendance by entering student details into the Android application, and it will generate a QR code. That QR code will be scanned and matched against the stored QR code for that particular student. This way, this system leads students to cheat on the attendance system by allowing any person to enter any student's details and scan then mark his/her attendance. The same Android application is provided to lecturers with more privileges. Students have to enter their data every time to generate a QR code to scan, and it is the time-wasting approach. Also, that system is only available for the Android platform, and that will make a significant problem for a student who owns a Smartphone that does not run with the Android operating system. It does not provide a solution for students who do not own any device or Smartphone [5].

Smart Student Attendance System proposed by other research provide two main interfaces for lecturers and students. Lecturers manage attendance records using a web application and students, and students get the attendance by scanning QR codes using an Android application. The Android application also provides an interface to view the monthly attendance record sent by the lecturers. This approach allows cheaters to share the QR code with outsiders of the lecture premises and mark the attendance. This system gives students permission to log in and register to the Android application, leading them to cheat by login into multiple accounts from the same device and mark the attendance for several students. In this system also, the mobile application is only for the Android platform. So, other mobile users and students who do not own a Smartphone face an issue when marking attendance [6].

It has been proposed a QR-based attendance system that generates the QR code by the instructor. Students scan the QR code using a Smartphone marketed by the institute. At the time of the scan, the student's facial image is also taken and compared against the student's stored image when registered. Since this system uses facial recognition technology, any person can provide a photograph of a student to scan in the facial recognition step. Same as other methodologies, students can share the QR code because of this single QR code mechanism. Before scanning the QR code, students have to scan their face, which will also cost some time. This will also affect the efficiency of the system since it has wider bandwidth and resources [7].

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3 PROPOSED SYSTEM

The proposed system, iQR Smart Attendance System, includes two main functionalities, such as attendance automation and real-time attendance.

Attendance automation

First, an authorized person or party (System Administrators) who have access to all proposed system privileges and system administrators create the system accounts for both lecturers and students with necessary information (Fig.1). Any existing database which contains this information can also be connected to the system. Then, system administrators' responsibility is to allocate lecturers and students to their respective course modules and provide necessary permissions appointing system roles. System administrators should create user accounts for all the expected stakeholders of this system to grant the privilege of accessing the system and allocating user roles concerning their university role. System administrators are eligible to update system user privileges as they wish. All user accounts should be created with university email id and password, which can be changed by the users later from the profile settings. The user login credentials and system access limitations will depend on the system administrator's user role. This way, unauthorized system accesses, and security breaches can be eliminated.
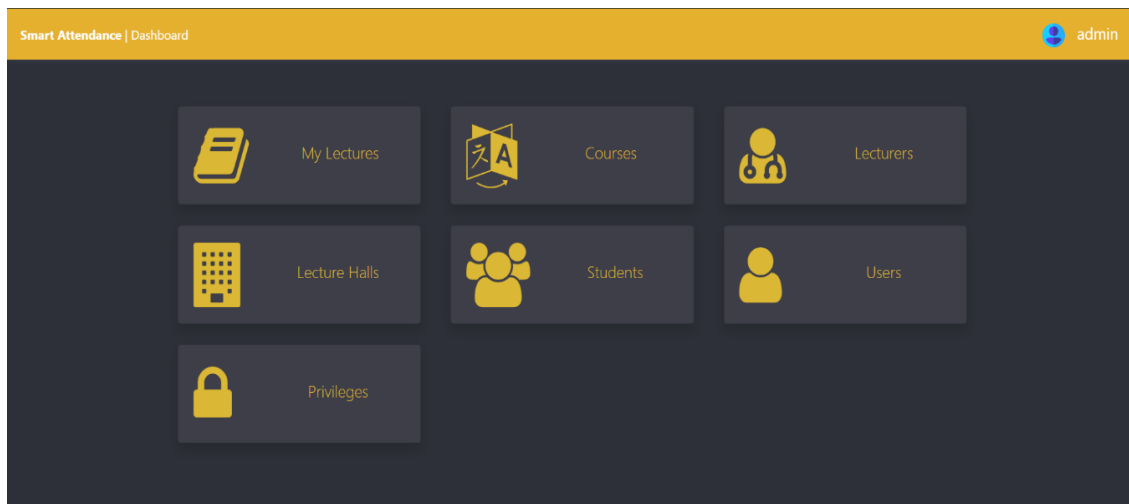

Fig. 1. iQR Smart Attendance System Administrator Dashboard

Lecturers can create attendance marking sessions before the lecture time at any time, and those will be pending until the lecturer decides to put it into an active state (Fig. 2). Lecturers are also permitted to pick up a particular period to allow students to mark attendance. Only in an active state can students mark their attendance by scanning the QR code displayed on a screen at the particular lecture hall or laboratory, etc. (Fig. 3). The lecturer does not have to interact with anything later. Still, he/she will be able to monitor the attendance marking session as the attendance-marked students' index numbers are updated on the screen in real-time.
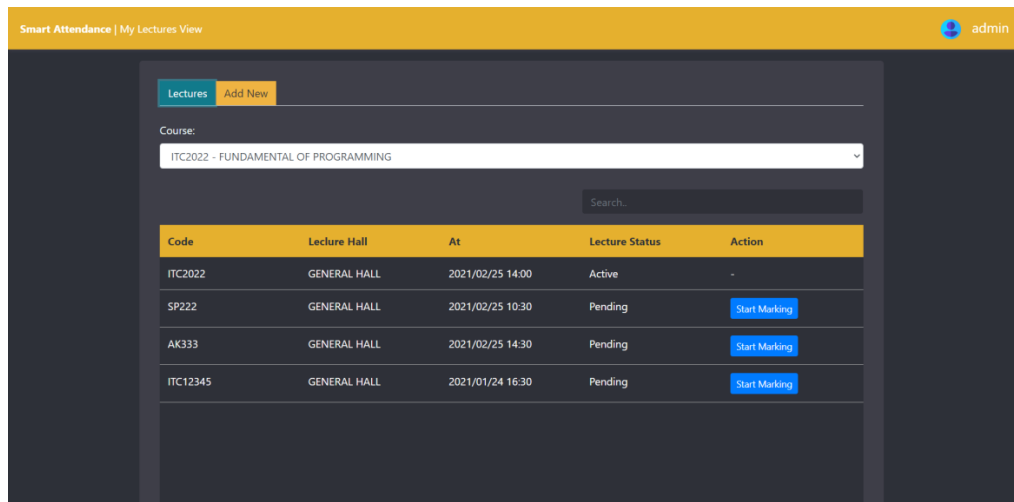
Fig. 2. "My Lectures View" available for Lecturers to start marking students' attendance
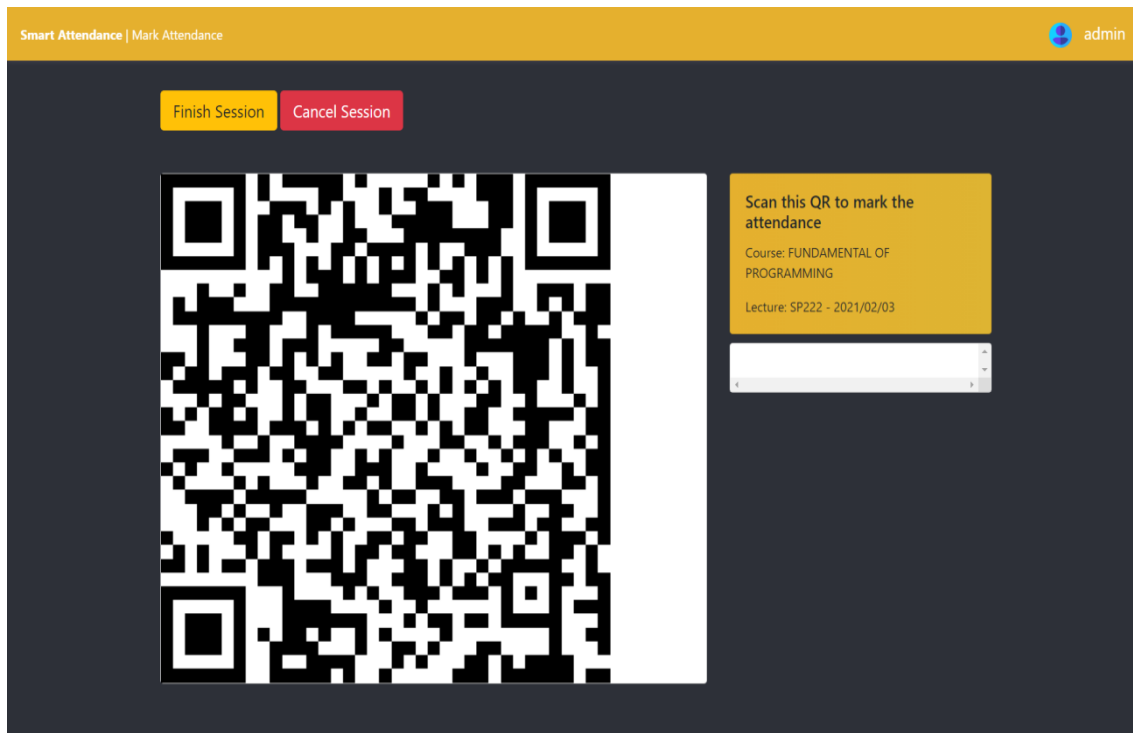

Fig. 3.Series of QR codes available to scan and scanned students' index numbers are shown as a list

Almost all the time, the non-academic staff is responsible for allowing students who have predefined minimum attendance percentage for that particular course module to sit for a semester-end exam with the lecturer or the instructor's acknowledgment. The non-academic staff does not have to calculate attendance percentage with the proposed system since it is automated. Any interested party who is privileged to access attendance data can observe attendance data without boundaries.

Real-time attendance

Users who have the user role of 'Student' are permitted to use the iQR mobile application, which is available for both Google Android operating system and Apple IOS operating system, to download and sign-in to their respective user account. Once students sign-in, they can use the user-friendly mobile application supporting both the Android operating and IOS operating systems to mark their attendance by

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scanning the QR code displayed on the screen. Also, it provides the current attendance percentage of every course module of that particular student and the history records of attendance marking (Fig. 4).
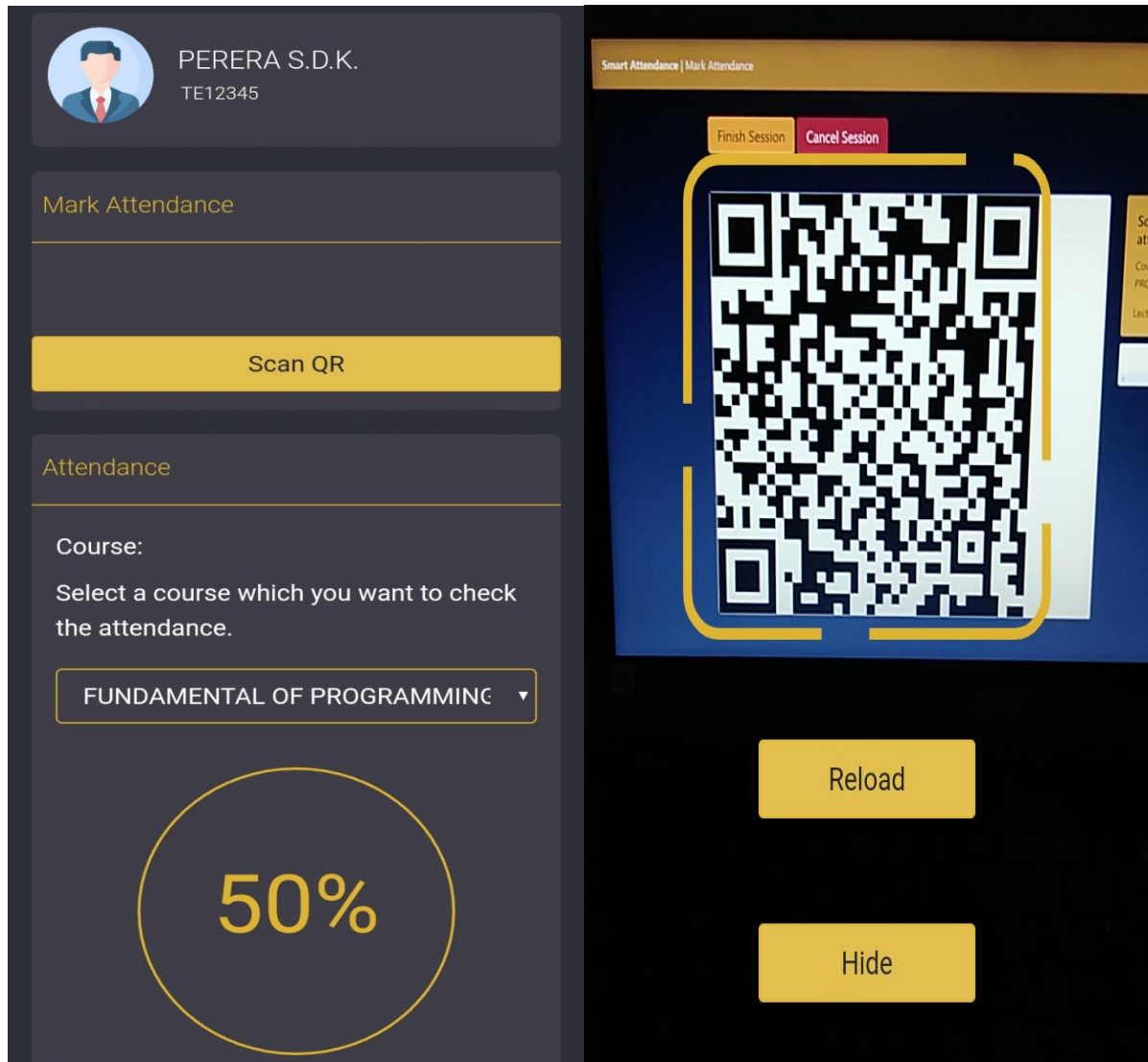

Fig. 4. QR scanning process

Fig. 5 represents the QR code dashboard, and the scanning interface with its operational flow happens inside a mobile application. The mobile application dashboard shows the attendance history with the percentage of every registered course module. The scanning interface allows students to scan a valid QR code to mark his/her attendance to a particular course module.
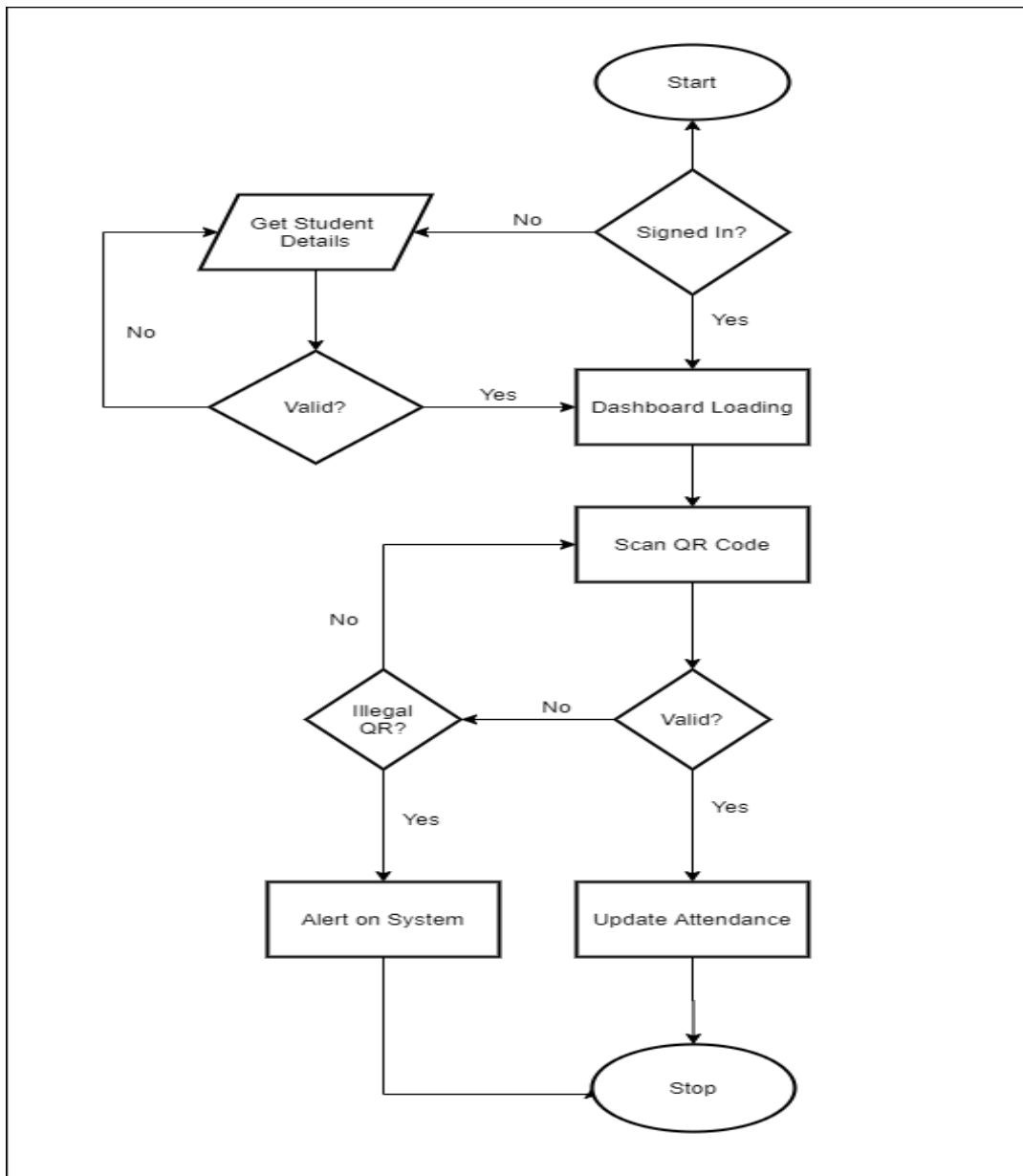
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Fig. 5. Flow Chart of the proposed system

All the QR code enabled attendance systems to use only one time QR code to get a particular lecture session's attendance. But in the proposed system, instead of a single QR code, there are a series of QR codes randomly generated and refreshed by the system within the given period. This way, students cannot share the QR code with any other person/s outside of the lecture hall willing to mark their attendance since a single QR code will expire after 15 seconds and then refreshed to another new random QR code. If a student tries to scan a older than 30 seconds, a QR code will be notified to the particular lecturer and the system administrator.

iQR Smart Attendance System provides different rights and privileges to the system stakeholders (Fig. 6). These rights and privileges are customizable as desire, and according to those defined rights and privileges, stakeholders can access the permitted system data and functions available. This mechanism can avoid most intrusion attempts and misuse of the system, leading the process of attendance marking to a highly secured productive online domain.

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Fig. 6. iQR rights and privilege levels to secure the system access

The mobile application does not support the logout function since it leads to a cheating possibility of logging out of the current account from the device mobile application and re-login with someone else's account credentials and marking his/her attendance. Students can only sign-in to their respective user accounts through mobile applications only from one device (Fig. 7). The iQR Smart Attendance System binds its IMEI number with that particular student user account.
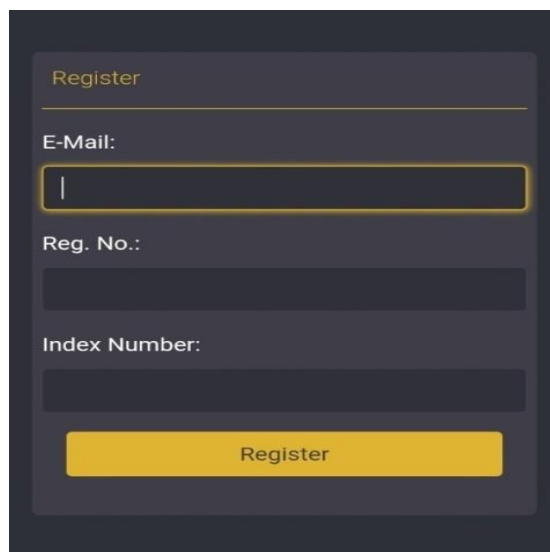

Fig. 7. iQR login API without re-login function

This way, bypassing the system security measures using a dual app or clone app feature can be detected since the system checks the logging device's IMEI number against registered IMEI numbers available in

iQR Smart Attendance System database at every time. Suppose students face any issue with that particular device or lose it. In that case, he/she can request the system administrator to suspend his/her account to re-login to the user account with an alternative solution.

Occasionally, students have no Smartphone or any capable device to mark his/her attendance using the proposed iQR Smart Attendance System. In the modern world, we cannot expect much of this scenario, but it is not something that cannot be neglected too. So, as a temporary and better solution, lecturers can mark the attendance of those particular students through the lecturers' user account.

4 CONCLUSION

It can be used multiple methods to get university students' attendance, but every procedure prompts various advantages and disadvantages. The proposed iQR Smart Attendance System is a highly productive and cost-efficient solution for taking student attendance and avoiding any cheating. The proposed QR code series concept helps both academic and non-academic staff avoid bogus attendances being marked. iQR mobile application allow students to mark their attendance instantly and automates the attendance process. As the system brings automation to the overall process, all the parties do not have to be bothered about calculations and other stuff regarding student attendance. Privilege-wise system access helps secure the whole iQR Smart Attendance System from intruders that other online attendance systems cannot provide.

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