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# Android-based Attendance System using QR Code and Fingerprint Features

E. Jercy[1], R. Kavya[2], M. S. Pavithra[3], T. Revathi[4], I. Stephie Rachel[5]
[1, 2, 3, 4]*UG student,* [5]*Teaching fellow, Department of IT, University College of Engineering, Nagercoil, Tamil Nadu, India*

***Abstract:*** ***Smartphones acts as a companion to people all over the world. It provides numerous benefits to its users. Smartphones can be used within the academic institution to manage student's attendance. There are different methods to maintain attendance such as biometrics. This paper aims to develop the android based attendance system for students using QR code and fingerprint feature. A decoding algorithm is used to verify QR code and fingerprint extraction and matching techniques is used. This system mainly reduces time for taking attendance and saves the lecturing time.***
***Keywords: QR code, Fingerprint, Attendance, Android, SMS.***

## I. INTRODUCTION

The student's attendance management is a major problem to access student performance in the classroom. The traditional way of taking attendance using paper and pen and recording manually and then converting it into desktop application is a difficult task and time consuming. More time and many efforts are spent by the staff of the department to prepare sheets and documents to take attendance for each student. Moreover, there may be loss or damage of the attendance sheets. In many organizations, attendance is used for various purposes. These purposes include record keeping, assessment of students and promotion of consistent attendance in class.

As new technology rapidly evolves, there are various ways of capturing student's attendance. The widespread uses of smartphones at an unprecedented rate have revolutionized the way people access to information particularly in the education sector. There are various technologies available that enable and assist educators to streamline their attendance taking activities. A few available solutions are hardware incline such as using radio frequency identification, biometrics, software based solutions for attendance management or both using software and hardware.

## II. OBJECTIVE

The purpose of our proposed work is to minimize the work load of the faculty while taking attendance and to prevent fake attendance. The main objective is to develop an android application for taking attendance in colleges.

The main objectives of this proposed work are explained below.

*A.* Minimize the work load of the faculty.
*B.* To prevent fake attendance.
*C.* To avoid more paper work.
*D.* To save lecture time.
*E.* Increase the speed at which attendance can be scanned.
*F.* Reduce hardware requirement.
*G.* Safe and secured personal information system.

## III.LITERATURE SURVEY

Awadhesh Kumar and Ajeet Kumar Nigam [1] proposed a fast and efficient attendance tracking system using QR code was developed and its goal is to break the maximum 50 student class size. It requires minimum hardware, and maintained at minimum cost.

B.Dinesh Kumar and S.Kareemulla [2] developed an attendance system by scanning the QR code using a webcam. The data is recorded and updated in a database for further retrieval. The Reed Solomon error code correction is applied to determine the authenticity of the code. If the attendance percentages fall below 85%, a warning letter will be issued to the student.

C.O. Akinduyite et al., [3] proposed a system in which QR Code is provided for students so that when student scan that QR Code, date and time of scanning QR Code will be stored in database. The device's camera read the QR code printed on the students' cards. Then the attendance list is uploaded in the database and can be saved as a file.

D. Deugo [4] developed a system where QR code scanner is used to scan the student's attendance and update his/her attendance in the database. The database can then be queried to find the students with minimum attendance a warning SMS/mail will be sent to the students whose chances are there to come in defaulters. It also provides voice based QR code attendance which will prevent fake attendance from any student.

Ganesh Rathod et al., [5] introduced the barcode based automatic examination attendance system on smartphone. The administrator insert halls, exam schedules and venues etc. into the database server. The lecturer will login and select the subject and exam hall. The students will scan their student card while entering the hall to confirm their attendance. If the student is valid for the exam, he/she will be allowed to proceed into the exam.

Md. Milon Islam et al., [6] proposed the paper that focuses on the high capacity QR Codes for encoding image within barcode symbol. It suggest a technique for data compression which in turn helps to increase the data capacity of QR Codes generated for image. The results are compared with the normal QR Codes to find the efficiency of the new technique of encoding followed by compression for generating optimal QR code.

Md Rizal Md Hendry et al., [7] introduced the application based attendance system for smartphone. The main benefits of this system is that the teacher can get computed percentage, can print hard copy with details attendance information, can save data in phone database as well as save data to remote server database.

Rehman Ullah Khan et al., [8] proposed a new automatic attendance management system integrated with fingerprint authentication. Enrolment and authentication processes are involved. The fingerprint image of the user is captured and the extracted features are compared with the one which is already stored in the database. If the match is successful, attendance is updated in the database.

Rahul Sharma et al., [9] developed a mobile app which scans the QR code which acts as user ID and uses fingerprint or voice recognition for verification. In the proposed system smartphones are used instead of separate machine for attendance check-in. The user should login his ID and confirm it using fingerprint. Not all the smartphones support fingerprint therefore voice command can be used. The fingerprint technique used is minutiae and texture features algorithm. The voice recognition algorithm used is matching of random alphabets.

Sunil Jadhav et al., [10], proposed a paper that explain various algorithms and technique which gave the accurate results for the fingerprint recognition system was explained. For enhancing the performance and accuracy of biometric fingerprint recognition system a lot of algorithms and techniques are proposed.

## IV. ARCHITECTURE DESIGN

In our system architecture, there are two modules student and faculty. Student will scan their QR Code and fingerprint. At that time student attendance will automatically updated in the database. Then the attendance report is generated and send it to the faculty for analysis. The attendance details can be viewed by the student through this application and the daily attendance status of the student will be send to their parent's mobile number. The list of students who have less than 75% of attendance is generated by this system and send it to the defaulter. Fig. 1 explains the process of taking attendance using the application running in the smartphone.

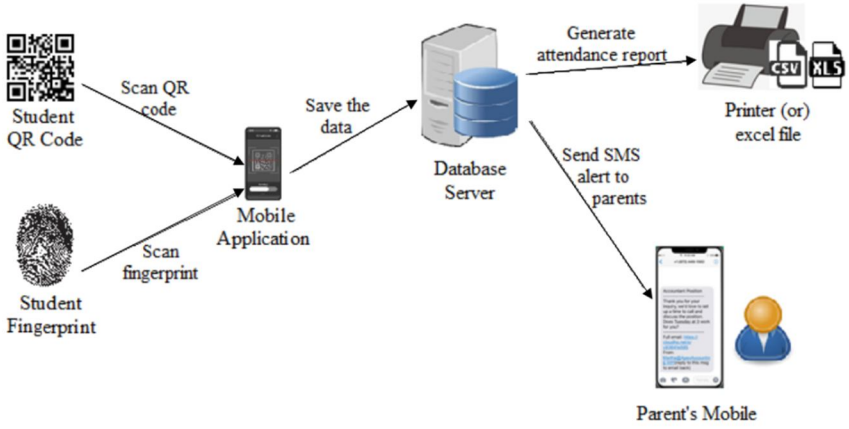


Fig. 1 Process of attendance management system using QR code and fingerprint

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## V. METHODOLOGY

The Error Correction in QR code is done using Reed Solomon Error Correction Code (ECC). The fingerprint technique used is minutiae-based and Long Digital Straight Segments (LDSSs) method.

### *A. Reed Solomon Error Correction Code (ECC)*

The Reed-Solomon code is a block-based error correcting code is the widely used in error correction technique. It is the easiest encoding techniques. It reads the bar code even it is damaged a lot.

Reed Solomon encoder takes a block of k digital data at a time and append 2t parity bits. Reed Solomon decoder reads each block, correct errors and recover the original data. Fig. 2 describes the Reed Solomon code block.

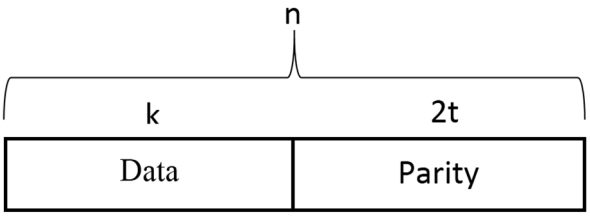


Fig. 2 Reed Solomon code block

*1)* Reed Solomon error correction code can be denoted as RS(n,k).
*2)* Block length is n bits.
*3)* Data size is k bits.
*4)* Parity size, 2t is (n-k) bits, where t is the number of errors which can be corrected by this code.
*5)* Minimum distance, d is 2t+1.

### *B. Minutiae Score Matching Technique*

There are three fingerprint characteristics. They are

*1)* *Ridge Ending:* It is the point at which a ridge ends.
*2)* *Ridge Bifurcation:* It is the point where a ridge splits into branches.
*3)* *Fingerprint Core:* It is the central part of the fingerprint.

Minutiae points are denoted as (x, y, d, t), where x and y are coordinates, d is the direction of minutiae point and t is the minutiae type. Fingerprint core is denoted as ($x_c$, $y_c$), where $x_c$ and $y_c$ are coordinates.

$$P = ((x_1^P, y_1^P, d_1^P, t_1^P), \dots\dots, (x_M^P, y_M^P, d_M^P, t_M^P)) \quad \text{.....(1)}$$

Eqn. (1) denotes M minutiae points of template fingerprint

$$R = (x_c^P, y_c^P) \quad \text{.....(2)}$$

Eqn. (2) denotes the template fingerprint core

$$Q = ((x_1^Q, y_1^Q, d_1^Q, t_1^Q), \dots\dots, (x_N^Q, y_N^Q, d_N^Q, t_N^Q)) \quad \text{.....(3)}$$

Eqn. (3) denotes N minutiae points of input fingerprint

$$S = (x_c^Q, y_c^Q) \quad \text{.....(4)}$$

Eqn. (4) denotes input fingerprint core

Minutiae points in polar coordinates is denoted as ($r_i$, $\theta_i$, $\alpha_i$, $t_i$).

$$r_i = \sqrt{(x_i - x_r)^2 + (y_i - y_r)^2} \quad \text{.....(5)}$$

Eqn. (5) denotes the radial distance, $r_i$

$$\theta_i = \tan^{-1}\left(\frac{y_i - y_r}{x_i - x_r}\right) + rot_i \quad \text{.....(6)}$$

Eqn. (6) denotes the radial angle, $\theta_i$

$$\alpha_i = d_i - d_r \quad \text{.....(7)}$$

Eqn. (7) denotes the minutiae direction, $\alpha_i$

$$t_i = t_i \quad \text{.....(8)}$$

Eqn. (8) denotes the minutiae type, $t_i$

Where $rot_i$ in eqn. (6) is the difference angle of reference points.

The performance of fingerprint recognition system is measured by two parameters, namely False Accept Rate (FAR), False Reject Rate (FRR).

$$FAR = \frac{No.of\ rejected\ fingerprint}{Total\ no.of\ matched\ fingerprint} \times 100\% \quad \text{.....(9)}$$

Eqn. (9) explains the imposter matching of fingerprint

$$FRR = \frac{No.of\ accepted\ fingerprint}{Total\ no.of\ matched\ fingerprint} \times 100\% \quad \text{.....(10)}$$

Eqn. (10) explains the genuine matching of fingerprint

*a) Algorithm*

*i)* *Input:* Gray-scale fingerprint image.

*ii)* *Output:* Verified fingerprint

1. The input fingerprint is binarized as 0 and 1
2. The binarized fingerprint is thinned to reduce the thickness of ridges
3. The location and angle of minutiae points are found
4. The minutiae points in the fingerprint image are extracted
5. The minutiae of the input fingerprint is matched with the template
6. If the matching score is 1, the fingerprint is matched. Otherwise, it is not matched.

*C. Long Digital Straight Segments (LDSSs)*

Feature representation is denoted by four parameters (x, y, θ, Length) where (x,y) is middle point, Length(s) is length of the straight segment, θ(s) is the orientation of the segment. Transformed feature is denoted by four parameters (x', y', θ', Length').

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos\emptyset & \sin\emptyset \\ -\sin\emptyset & \cos\emptyset \end{pmatrix} \begin{pmatrix} x - x_0 \\ y - y_0 \end{pmatrix} + \begin{pmatrix} x_0 + trans_x \\ y_0 + trans_y \end{pmatrix}$$

$$\theta' = \theta + \emptyset$$

$$Length' = Length$$

There are two types of transformation:

*1)* Translation ($trans_x$, $trans_y$),

*2)* Rotation (angle(θ) and center of rotation ($x_0$, $y_0$)).

## VI. CONCLUSION AND FUTURE SCOPE

In the previous system, the attendance is marked in the paper. Hence it takes more time and also fake attendance can be given by the student. Our system provides QR code and fingerprint based attendance for every lecture which will prevent fake attendance from any student. Student will receive daily attendance status to their parent's mobile number through SMS. The defaulters list will be generated every month and can be viewed by faculty.

In future, many projects will be emerged to convert the normal classroom into a smart classroom. As a part of this invention, our project can be extended into a smart class based automated attendance tracking system. Our project software can be installed in a device which is placed in front of every classroom. The students scan their QR code and fingerprint through this device and the attendance will be updated automatically.

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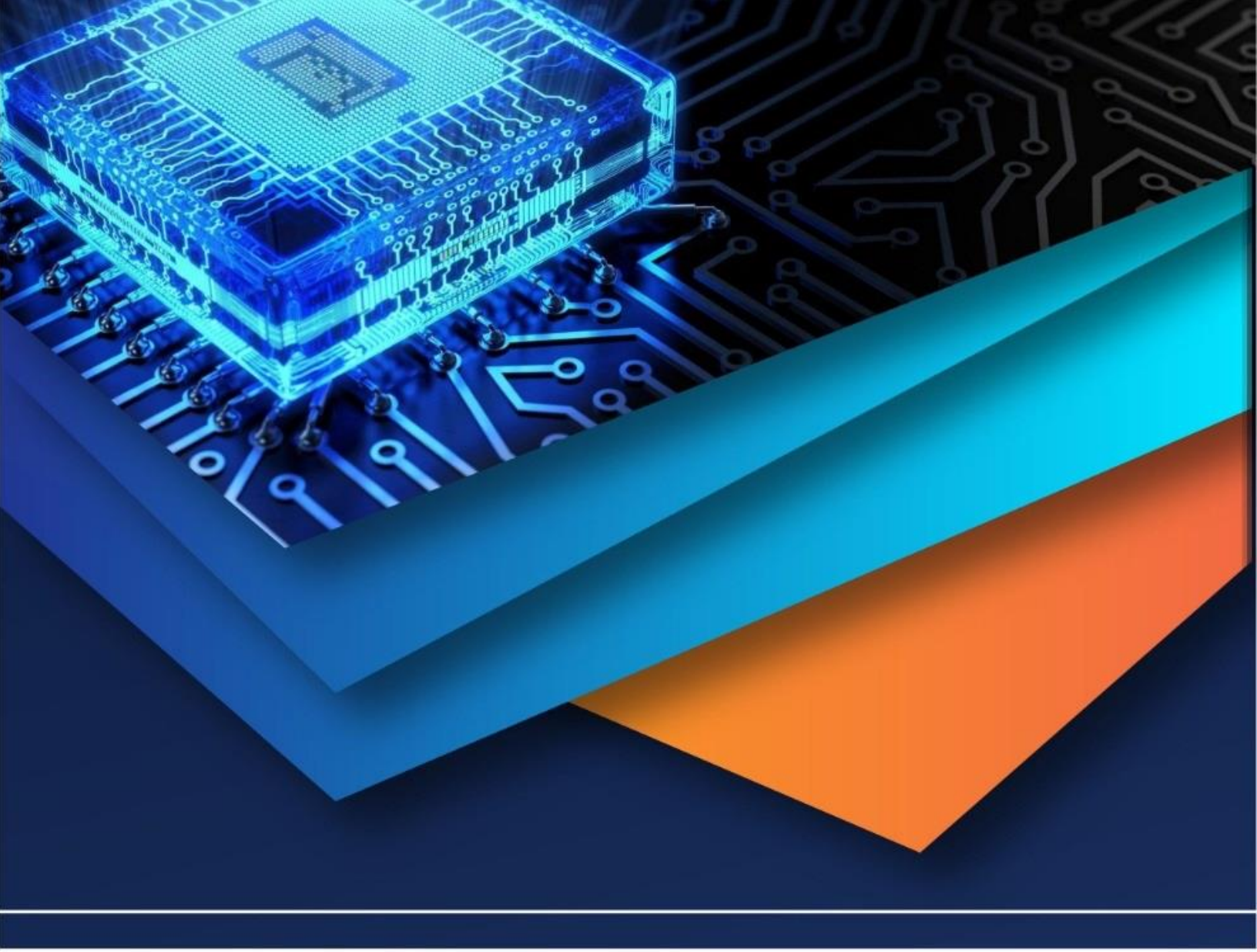

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