QR Code-Based Attendance System Using Deep Learning

P. Jacob Vijaya Kumar[1], Patan Madarvali[2], Basapuram Mahesh[2], Jammana Govardhan Reddy[2],
Chakali Mahidhar[2] and Dwaram Satish Reddy[2]

[1]*Department of Computer Science and AI/ML, Santhiram Engineering College, Nandyal-518501, Andhra Pradesh, India*
[2]*Department of Computer Science and Design, Santhiram Engineering College, Nandyal-518501, Andhra Pradesh, India*

Keywords: QR Code, Attendance System, Deep Learning, Convolutional Neural Networks (CNNs), Image Processing, Automation.

Abstract: Integrating QR code generation with deep gaining knowledge of has revolutionized attendance control structures. This paper offers a complicated QR code-based attendance machine augmented with deep mastering strategies to enhance accuracy, scalability, and efficiency. The gadget leverages QR codes for speedy, contactless statistics retrieval, even as deep mastering models address challenges along with QR code deformation, terrible lights conditions, and real-time processing. The CNNs are used to detect the QR code and improve accuracy, even under suboptimal conditions. In addition, a user -friendly interface ensures spontaneous operations for both administrators and participants.

1 INTRODUCTION

Traditional attendance systems face demanding situations, including manual errors, time inefficiency, and scalability barriers. QR code-primarily based systems provide a contactless, fast, and automatic opportunity. However, conventional QR scanners battle with distortions, low lights, or partial obstructions. By integrating deep studying, this gadget enhances robustness, ensuring reliable performance in various situations.

2 LITERATURE REVIEW

2.1 QR Codes for Taking Attendance

QR codes are those square barcodes you scan with your phone. They're popular for attendance because they're:

- Simple to use
- Quick to process
- Able to hold lots of information

But basic QR attendance systems have some problems:

- People can cheat by creating fake QR codes
- They struggle with large groups
- They don't work well in poor lighting or when the code is at an odd angle

That's where AI comes in to help solve these issues.

2.2 How AI Improves These System

Researchers are using advanced AI techniques to make QR attendance systems better:

- Better QR Code Reading: AI models like YOLO can find and read QR codes quickly, even in bad lighting or when the code is distorted.
- Catching Cheaters: AI can spot fake QR codes by finding tiny details that humans might miss.
- Double-Checking Identity: Some systems pair QR codes with facial recognition - you scan the code, then the system checks your face to make sure it's you.

2.3 Recent Breakthroughs

- One research team created a system that uses both QR codes and facial recognition, making it much harder to cheat.

- Another team developed a super-fast QR code detector that works well even when people are moving around.
- A third group built an AI system that can spot tampered QR codes by examining unusual patterns in the pixels.

2.4 Current Challenges and What's next

Despite this progress, some hurdles remain:

- Processing Power: AI requires serious computing power, which can be a problem for real-time applications.
- Training Data: Teaching AI to recognize all possible QR code variations requires lots of example data.
- Connected Devices: Future systems might connect QR attendance with smart devices for seamless tracking.

2.5 Researchers Are now Working on

- Creating lighter AI models that don't need as much computing power
- Developing methods that protect privacy while improving security
- Combining QR codes with fingerprints or voice recognition for extra security.

3 EXISTING SYSTEMS

3.1 Old-School QR Code Attendance Problems

- People can cheat by using fake QR codes
- Doesn't work well in poor lighting or weird angles
- Just scanning a code doesn't prove it's you

3.2 QR Systems with Brain QR Codes that Recognize Your Face

How it works: Scan your QR code, and then the system checks your face to make sure it's you.

Cool features:
- Uses smart computer vision to match your face with your stored photo
- Much harder to cheat the system

Drawbacks:
- Needs powerful computers to work quickly
- Struggles in dark rooms

3.3 Super-Fast QR Code Spotting How It Works

Uses a smart technology called YOLO that can find and read QR codes instantly, even when they're moving.

Cool features:
- Can spot and process many QR codes at once
- Works well even in challenging conditions

Drawbacks:
- Needs a gaming-level graphics card to run smoothly
- Still has trouble with badly damaged QR codes

3.4 Fake QR Code Detective

How it works: The system learns to spot tiny differences between real and fake QR codes that humans can't see.

Cool features:
- Catches people trying to use fake codes
- Makes the whole system more trustworthy

Drawbacks:
- Needs to study thousands of fake and real codes to learn the difference
- Uses lots of computing power

3.5 Connected Smart Attendance

How it works: Combines QR codes with internet-connected devices and AI to track attendance in real time.

Cool features:
- Attendance data gets stored in the cloud instantly
- Can show patterns like who's usually late or which days have poor attendance

Drawbacks:
- Needs a good internet connection
- Costs more to set up initially

3.6 Triple-Check Security

How it works: After scanning your QR code, you also need to verify your fingerprint or voice.

Cool features:
- Extremely secure nearly impossible to cheat
- Perfect for high-security places

Drawbacks:
- Requires extra hardware like fingerprint scanners
- More complicated and expensive

- Top**Comparison of Existing Systems (Table 1)**

Table 1: Comparison of Existing Systems.

System	Key Features	Advantages	Limitations
Hybrid QR Code + Face Recognition	Combines QR code scanning with face recognition.	High accuracy, robust against spoofing.	Computationally intensive, performance degrades in poor lighting.
Tampered QR Code Detection	Detects fake QR codes using deep learning.	Enhances security, and high accuracy.	Requires large dataset, computationally intensive.
IoT-Integrated System	Combines QR codes with IoT for real-time data processing.	Scalable, provides real-time analytics.	Requires stable internet, high setup cost.
Multi-Factor Authentication	Adds biometric authentication (e.g., fingerprint, voice) to QR code scanning.	Highly secure, and suitable for high-security environments.	Requires additional hardware, increased complexity, and cost.

4 METHODOLOGY

4.1 Problem Definition

To accomplish the objectives outlined in advance, a dependent step-through-step method has been implemented.

The methodology is defined as follows:

Develop a QR Code Generator Android Application: Create an Android app that generates QR codes the usage of student-specific records including roll wide variety and scholar ID.

Develop an Attendance Management Android Application: Build an Android app capable of scanning QR codes to file attendance for precise topics and routinely generate attendance sheets based at the accumulated statistics.

4.2 Software Requirements

- **Development Tools:** Android Studio (for cellular app improvement)
- Python (for deep mastering version education and backend processing)
- MS Excel

4.3 Hardware Requirements

Android Smartphone.

4.4 Inputs / Outputs

- **Inputs:** QR codes, and Bar codes
- **Outputs:** Excel sheets

Database usage
MYSQL Database

4.5 Use Case

The machine involves more than one actors, each with precise roles and functionalities. These actors and their interactions inside the QR code-primarily based attendance machine are defined underneath:

- **Student:**
  o Generates a personalized QR code using the Android app, which incorporates their specific identification details which include roll wide variety and student ID.
  o Presents the QR code for scanning throughout attendance recording.

- **Teacher/Administrator:**
  o Uses the Android app to scan student QR codes during class or events.
  o Manages attendance records for specific subjects or sessions.
  o Generates and reviews attendance sheets automatically created by the system.

- **System:**
  o Validates scanned QR codes to ensure accuracy and prevent duplication.
  o Stores attendance data securely in a database.
  o Generates real-time attendance reports for teachers or administrators.

This use case (figure 1) highlights the seamless interaction between students, teachers, and the system, ensuring an efficient and reliable attendance tracking process.
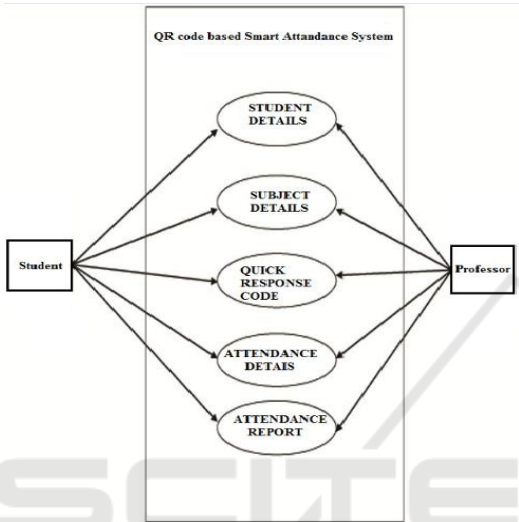

Figure 1: Use Case Diagram.

4.6 Data Flow Diagram (DFD)

The data flow diagram (DFD) of the system is illustrated in Figure 2:
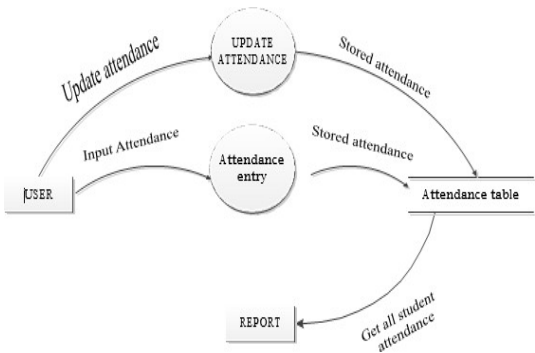
Figure 2: DFD.

4.7 Database

The scholar attendance database is managed by the use of SQLite. It shops the subsequent facts:

- Subject name and code.
- Student name and ID.
- Attendance repute (present/absent).

The database desk structure for a specific issue is shown underneath in figure 3:

Figure 3: The Database Table Schema for Individual Subject Records.

4.8 Sequence Diagram

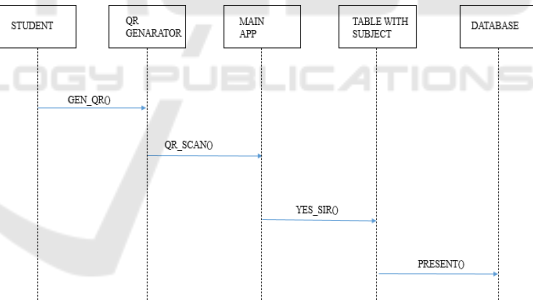The system's operational workflow is depicted in the sequence diagram (figure 4):

Figure 4: Sequence Diagram.

The sequence diagram demonstrates the step-by-step interaction between the student, professor, and the system, including:

- Student QR code generation and presentation.
- The professor scanned the QR code and recorded attendance.
- System validation and storage of attendance data.
- Generation of attendance reports.

4.9 Flowchart

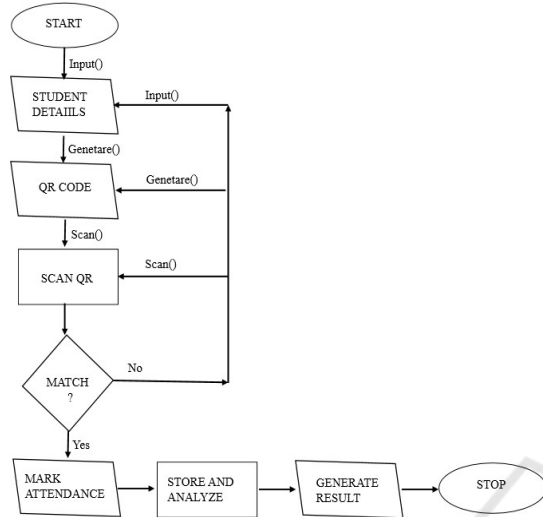The flowchart of the QR Code-Based Attendance System is shown in figure 5:

Figure 5: Flowchart of the Application System.

5 EXECUTION AND OUTCOMES

5.1 Model Evaluation

We tested a range of deep learning architectures:

- **Model-1**: CNN (Our proposed framework for capturing temporal characteristics).
- **Model-2**: LSTM (Captures long-range dependencies in price fluctuations).
- **Model-3**: GRU (Gated Recurrent Units for efficient sequence analysis).
- **Model-4**: Random Forest (Baseline machine learning approach for reference).
- **Model-5**: ARIA (Classic model for time-series forecasting).

5.2 Export the Attendance to CSV/EXCLS Files

- To export the overall attendance sheet in CSV or XLS format, the trainer or administrator need to pick out the relevant problem code. The device then compiles the attendance records and generates a file in which:

- 0 represents an absent status.
- 1 represents a present status.

Below is a screenshot (figure 6) of the generated CSV file, showcasing the attendance records in a structured and easily accessible format.

This feature allows for efficient record-keeping and analysis of attendance data, making it convenient for teachers and administrators to manage and review attendance trends.

Figure 6: Export the Attendance to CSV/EXCLS Files.

6 CONCLUSIONS

The advanced gadget offered in this paper has been efficiently designed and examined, demonstrating its functionality to analyze and export pupil attendance reputation correctly. Attendance tracking structures play a crucial position in our daily lives, and among numerous code-scanning technologies, the QR Code-Based Attendance System will be the most correct and reliable. In this task document, we have delivered the idea of the Attendance Monitoring System and highlighted its numerous advantages. By leveraging QR code generation, this machine provides an efficient and green answer for storing attendance records digitally on smartphones, doing away with the want for paper-based strategies. This not only enhances accuracy however additionally contributes to sustainability and comfort, making it an ideal desire for modern-day educational and professional environments.

7 FUTURE EXTENT

Our next paintings will focus on giving pupils access to notes and ignored elegant issues. Complete control over instructors with safer and more reliable substitutes. Lastly, we conclude that this attendance tracking system will solve the problem of actual worldwide attendance if it is combined with a facial recognition device.

REFERENCES

Brownlee, J. (2020). "Deep Learning for Time Series Forecasting: Predict the Future with MLPs, CNNs, and LSTMs in Python." Machine Learning Mastery.

Chaitanya, V. Lakshmi. "Machine Learning Based Predictive Model for Data Fusion Based Intruder Alert System." journal of algebraic statistics 13.2 (2022): 2477-2483

Devi, M. Sharmila, et al. "Extracting and Analyzing Features in Natural Language Processing for Deep Learning with English Language." Journal of Research Publication and Reviews 4.4 (2023): 497-502.

FAO. (2021). "The State of Agricultural Commodity Markets: Trends and Challenges in Price Volatility." FAO Publications.

Food and Agriculture Organization (FAO). (2023). "Global Information and Early Warning System (GIEWS) on Food and Agriculture." FAO Publications.

Li, H., et al. (2021). "A Comparative Analysis of Machine Learning and Deep Learning Techniques for Time-Series Forecasting in Agricultural Markets." IEEE Transactions on AI, 29(4), 320-333.

Mishra, D., & Singh, P. (2020). "A Survey of Machine Learning Methods for Predicting Crop Prices." International Journal of Data Science, 12(2), 112-125.

Mr.M.Amareswara Kumar, "Baby care warning system based on IoT and GSM to prevent leaving a child in a parked car" in International Conference on Emerging Trends in Electronics and Communication Engineering - 2023, API Proceedings July-2024

Parumanchala Bhaskar, et al. "Machine Learning Based Predictive Model for Closed Loop Air Filtering System." Journal of Algebraic Statistics 13.3 (2022): 416-423.

Parumanchala Bhaskar, et al. "Incorporating Deep Learning Techniques to Estimate the Damage of Cars During the Accidents" AIP Conference Proceedings. Vol. 3028. No. 1. AIP Publishing, 2024.

Patel, A., & Kumar, R. (2022). "Utilizing Deep Learning for Predicting Agricultural Prices." Journal of AI Research in Agriculture, 18(3), 45-57.

Sharma, R., & Gupta, K. (2023). "Agricultural Market Forecasting Using Hybrid CNN- LSTM Models." Computational Intelligence in Agriculture, 30(4), 201-218.

World Bank. (2022). "Commodity Markets Outlook: The Impact of Climate Change on Agricultural Prices." World Bank Group.

Zhang, X., et al. (2019). "Models for Price Prediction in Agricultural Markets Using Neural Networks." Applied AI Review, 27(1), 98-115.