AUTOMATED TRAIN TICKET VERIFICATION SYSTEM

Abstract: This paper presents a futuristic approach to enhance the accuracy and efficiency of train ticket checking through the integration of advanced sensors, NFC technology, ESP32-CAM AI Thinker, and Arduino microcontrollers, supported by a scalable cloud database. Traditional methods of ticket verification in India rely heavily on manual inspections, leading to inefficiencies, errors, and increased operational costs.

The proposed system deploys deep sensors at entry points to detect passengers boarding the train and uses NFC readers for seamless, contactless ticket validation. The ESP32-CAM AI Thinker module is integrated to perform real-time image recognition for passenger verification and to detect any malpractices, such as unauthorized entry or invalid ticket usage. If any irregularities are detected, the ESP32-CAM captures images, which are stored securely in Firebase for further verification and monitoring.

Ticket data and image evidence are processed in real time by Arduino microcontrollers and securely stored in Firebase, a robust cloud storage solution that ensures centralized management and real-time access to records. Firebase facilitates smooth data synchronization and integration with monitoring systems, enhancing accessibility and scalability. This system ensures secure communication between sensors, microcontrollers, and the database, maintaining the integrity of ticket validation.

The modular design of the Arduino-based system, combined with image recognition capabilities of the ESP32-CAM, allows for easy adaptation across train configurations. By automating the ticket-checking process and introducing image-based anomaly detection, this solution reduces manual workload, minimizes human errors, and optimizes train operations. Additional benefits include improved punctuality, reduced labor costs, and enhanced passenger satisfaction, positioning this system as a significant advancement in modern rail transportation.