**Title:**

Smart RFID Simulation and Predictive Analytics for Attendance and Campus Payments

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**Abstract:**

In this paper, a novel RFID-based simulation system is presented for virtualizing in-campus transactions and attendance recording on the basis of a full virtual environment. Through the use of the MERN stack (MongoDB, Express.js, React.js, Node.js), the system virtualizes the physical RFID setup on the basis of browser-based simulation buttons that replicate RFID card scans. The operations record encrypted attendance and transaction data securely, rendering the system an affordable solution for schools with modest budgets. The system accommodates different user categories—students, parents, teachers, administrators, and merchants—with an individualized dashboard and access rights for each of them.

Along with monitoring attendance and payments, the platform incorporates in-house developed machine learning models that process real-time behavioral and contextual data. The models predict absenteeism and high-risk financial behavior and provide early warning to teachers and parents. Real-time communication is enabled via Socket.IO, with predictive analytics processed using a Python-based Flask microservice. The platform is completely virtual but modular and hardware-friendly, with easy integration with RFID/NFC devices to be enabled in the near future.

The platform is compatible with both offline and online academic settings and is in line with post-pandemic requirements of safe, touchless campus life. It improves institutional efficiency, fosters transparency, and raises the accountability of students with automatic insights and predictive feedback.

This project closes the gap between education technology concept and practical constraints by proposing a scalable, intelligent, and inclusive platform. By embracing simulation, AI, and real-time communication, it sets the stage for an education ecosystem that is future-proofed with data-driven decision making and enhanced student-parent-teacher collaboration.

**Keywords:**

rfid simulation, smart campus, machine learning, attendance prediction, digital wallet.

**Biography:**

Hossam Mohamed Elalimy is a final-year student at the Faculty of Computer Science, MSA University. His interests include intelligent systems, software architecture, and human-computer interaction. He has developed five websites: two full-stack, two frontend interfaces, and a hospital management system. He is currently building a Smart Clinic System and previously led the development of a simulation-based RFID attendance and campus payment system using MERN and machine learning. Hossam also works as a freelance web developer focused on real-world impact. His research explores simulation-driven educational platforms and behavioral analytics for student-centered and parent-centered campus technology ecosystems.