Campus-Wide RFID-Enabled Attendance System at the City College of New York

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The City College of New York

ENGL 21007: Writing for Engineering

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May 6, 2025

This proposal recommends implementing a campus-wide Radio Frequency Identification (RFID) attendance system for in-person courses at The City College of New York (CCNY). By replacing manual attendance methods such as roll calls and sign-in sheets with RFID-enabled ID cards and door scanners, the system would save classroom time, improve the accuracy of attendance records, and increase accountability for students, instructors and departments. The proposed solution integrates passive RFID tags, networked microcontrollers, and a secure web-based platform to automate attendance tracking while preserving user privacy. Real-time attendance data can be used to support student success initiatives, optimize course scheduling, and provide data-driven insights for faculty evaluations. Schools that have adopted similar systems report improved attendance, better academic performance, and reduced administrative burden. Our team has experience with embedded systems, RFID hardware, database design, and full-stack web development. This technical background has shaped a system design that is reliable, user-friendly, and scalable across the college. The projected initial cost of implementation is approximately $240,260, with annual operating costs estimated at $209,770. The system's long-term benefits including reclaimed instructional time, enhanced data access, and improved student outcomes, make it a worthwhile institutional investment.

Introduction

At the City College of New York (CCNY), many professors still rely on manual methods to take attendance for in-person classes. This often involves calling out names, passing around sign-in sheets, or using online forms. While this may seem simple, it takes up 5 to 10 minutes of class time every session (Mondal, 2020) and leaves room for errors and forgery. For instance, students can sign-in for friends who are not actually present, and names can be missed or misrecorded. These problems make it hard for professors and administrators to track who is really attending class and how often. A corollary consequence of inaccurate attendance information is the inability to make data-driven decisions about improving student resources, refining course curriculums, and making strong hiring choices.

The purpose of this proposal is to introduce a more accurate and time-saving solution. To solve this problem, we propose using Radio Frequency Identification (RFID) technology to automate the attendance taking process. RFID uses small chips inserted in student ID cards that can be scanned automatically by readers installed near classroom doors. This system would quickly record student and instructor attendance when they tap their ID card to the reader upon entering the classroom.

Research from Xanthipi Kyriazi (2019) and other case studies show that RFID systems are already helping schools around the world manage attendance more effectively and securely. It is also proven that “schools that monitored their attendance had better overall grades when compared to schools that didn’t” (Kyriazi, 2029).

This proposal focuses on launching an RFID-enabled attendance system across the entire CCNY campus, targeting in-person courses. In the following sections, we will describe how the system will work, the benefits it offers, the resources required and the total budget.

Project Description

An RFID-enabled attendance system is the solution for efficient attendance tracking at CCNY. By implementing this system professors will no longer need to conduct roll calls and sign-in sheets will be eliminated, saving classroom learning time and reducing the opportunity for incorrect or fabricated attendance records.

Functionality

The proposed RFID-enabled attendance system has two major functions:

1. It quickly and accurately tracks the attendance of students and instructors.
2. It provides a platform to view, analyze and learn from attendance data.

The setup is straightforward. Each student and instructor will have a scannable ID card, and each classroom will have a card scanner installed near the door. When an instructor arrives to teach a class, they will tap their ID card to the scanner to log their attendance. Similarly, when a student enters class, they will tap their card to record their attendance. The user experience is fast and easy.

An attendance data web application is part of the system. Users will be able to visit the website https://attendence.ccny.cuny.edu to access real time attendance data after they log in using their existing university login credentials. Different categories of users will have different levels of access:

- Students will have view-only access to their attendance records for all the courses they are enrolled in.

- Instructors will have access to attendance data for all the courses they teach. They will not be able to change data but can add comments to student records.
- Admins will have access to attendance data for all courses. They will not be able to change any data but will have the ability to add comments to instructor and student records.
- Superadmins will have access to all data and permission to modify data, giving them the flexibility to make corrections. This role is important for integrating human oversight into a largely automated system. Since only superadmins can directly alter attendance data, the integrity of the data's information is preserved.

The web interface will display attendance data in an easily digestible format using appropriate visualizations such as line graphs to show attendance rates over time and pie charts for average percentage of on-time attendance, late attendance, and absences. Instructors and admins will be able to view attendance data in aggregate for entire classes and the attendance records for individual students.

System Design

To implement efficient campus-wide attendance tracking that accommodates all students and instructors for in-person courses, this solution combines RFID technology, embedded systems, and a single web application into one cohesive system. **Figure 1** depicts the system's specific parts.

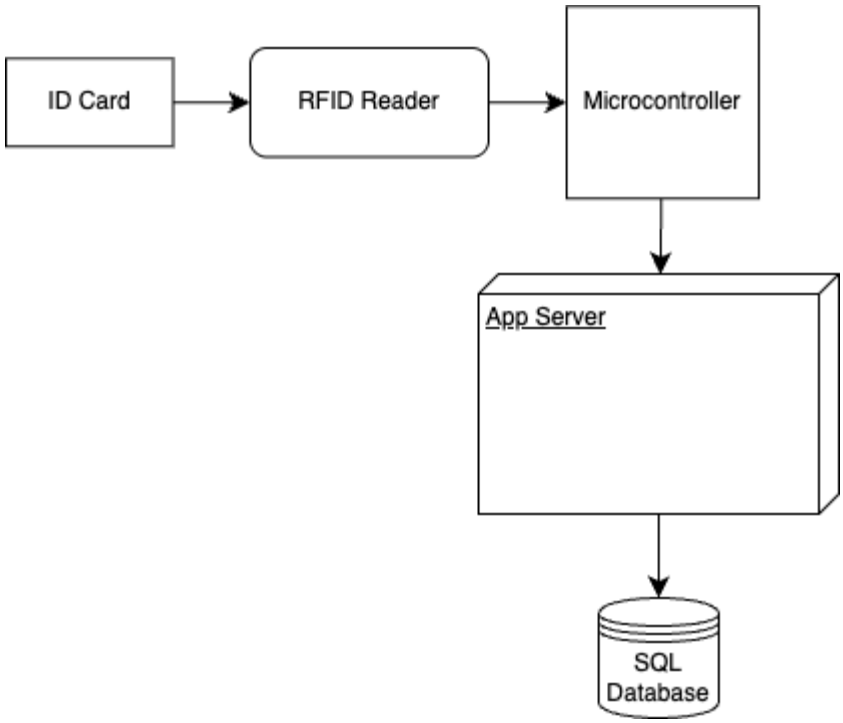

Figure 1. Main components of the RFID-enabled attendance system.

RFID technology uses radio waves to share information, typically sequences of numbers representing Unique Identifiers (UIDs). A RFID tag is a highly compact electronic device consisting of a microchip and antenna that can store and transmit a small amount of data. It can be extremely thin and inlayed into another material such as a plastic card (Kaczor, 2025). There are two types of RFID tags: active and passive. Passive RFID tags are smaller, thinner, and cheaper than active ones (Smiley, 2016). They work well for short distance communication and can last a lifetime since, unlike active RFID tags, they do not depend on an external power source (Smiley, 2016). Each student and instructor will be issued a passive RFID tag embedded into an ID card, printed with their photo and information, that stores their UID.

RFID readers are devices that communicate with RFID tags to retrieve the information stored on them. They will be required to read the UID stored on student and instructor ID cards.

Each RFID reader will communicate with a dedicated microcontroller, a lightweight, relatively cheap computer, that has wireless networking capabilities.

Each microcontroller will be associated with a specific classroom by storing the room's information in a configuration file on the device using the format: [building name] [floor number]/[room number]. When the microcontroller receives a UID from the RFID reader, it will securely send the UID, time, and room number to the app server using HTTPS over Wi-Fi.

The server will receive the information and perform two steps. The first is to validate the data, which entails determining if the student or instructor with the specified UID is enrolled in the course uniquely identified by the specified time and location. The second step is to create an attendance record for the individual, which will be persisted in a SQL database.

Privacy and Security

Perhaps the greatest objection against RFID-enabled attendance systems is privacy. Students are often against the notion of being continuously tracked. Unlike implementations on some campuses, this implementation directly addresses the issue by using passive, low-frequency (LF) RFID tags. These types of tags must be within 10cm of an RFID reader to be scanned (Zheng, n.d.). This means students must place their ID cards deliberately near an RFID reader to record their attendance and ensures that their location will never be constantly monitored as they move around campus.

Since the system stores confidential and sensitive data about students and instructors, another important concern is data security. To ensure personal data remains private, the system will implement appropriate security measures, which includes encrypting data in transit and storage. It also includes smoothly deactivating and replacing ID cards that are stolen or lost.

Data Analytics

Collecting attendance data is important because it reveals important patterns such as:

- Students who are frequently absent.
- Classes with low attendance.
- Attendance spikes or drops.
- Class attendance over time.
- Attendance rates across locations, disciplines, instructors, and class sizes.

This empowers university staff to make data-driven decisions about course scheduling, curriculum design, student support services, faculty to staff ratios, and instructor hiring. It helps instructors identify individual students with low attendance, determine the right course pacing, and improve their teaching. It also provides students with objective data about their class engagement.

Budget

The system's software is zero-cost since it relies on free frontend, backend, and database solutions. But hardware and human labor costs remain. Adopting this system across the entire campus will entail purchasing an RFID implanted ID card for each student and instructor, and an RFID reader and microcontroller per classroom. The latter two components will be assembled into an RFID scanner and installed in each classroom, incurring a human labor cost per room. The domain name, website hosting, and initial software development costs are constant. But regular maintenance will be a recurring, annual cost. **Table 1** lists all these costs.

Category	Item	Cost
Physical Components	RFID card (x1)	$0.30
	RFID reader (x1)	$8.50
	Microcontroller (x1)	$20.00
Software Deployment	Domain name (per year)	$10.00
	Website hosting (per year)	$7,200.00
Human Labor	Installation of RFID scanner (per room)	$50.00
	Initial software development cost	$5,000.00
	Regular maintenance (per year)	$200,000.00

Table 1. A list of all the initial and recurring costs of the system.

The initial cost refers to how much it would entail to set up the system for the entire campus and student body. It is a function of the number of classrooms the system is implemented across and the total number of students and instructors:

$$C(c, i) = [(RFID\,reader + microcontroller + installation) \cdot c]$$

$$+ (RFID\,card \cdot i)$$

$$+ (domain\,name + website\,hosting + software\,development)$$

- c is number of classrooms
- i is total number of students and instructors

For an average student population of 15,000 at CCNY (Office of Institutional Advancement & Communications and External Relations, 2024) and an estimated number of classrooms of 300, the initial cost of implementation is $240,260. See **Table 2** for the breakdown.

Category	Item	Cost
Physical Components	RFID cards	$4,500.00
	RFID readers	$2,550.00
	Microcontrollers	$6,000.00
Software Deployment	Domain name (1 year)	$10.00
	Website hosting (1 year)	$7,200.00
Human Labor	Installation of RFID scanners (per room)	$15,000.00
	Initial software development cost	$5,000.00
	Regular maintenance (1 year)	$200,000.00
	Total	**$240,260.00**

Table 2. Breakdown of the total initial cost of implementing the system for CCNY.

Once the system has been set up, the cost per year includes the price of ID cards for new students and instructors, retaining the domain name, hosting the web application, and paying an operations team of two or three people to maintain the system. The recurring cost, incurred annually from year two onwards is modeled by the function:

$$Y(i) = (RFID\ card \cdot i) + (domain\ name + website\ hosting + operations\ team)$$

- i is total number of students and instructors

Based on CCNY's Fall 2023 fact sheet, an overestimate of the total new and transfer undergraduate and graduate enrollment and new instructors for the entire academic year is 8,534 individuals (Office of Institutional Research, 2024). Therefore, the recurring cost for the 23-24 academic year would be $209,770.20.

Conclusion

Implementing an RFID-enabled attendance system at The City College of New York presents a practical solution to the limitations of current manual attendance methods. While the upfront investment may seem substantial, the long-term gains in efficiency, data accuracy, and instructional quality make the cost justifiable. The system would eliminate paper-based sign-in sheets, reduce the risk of human error, and save approximately 5 to 10 minutes per class session (Mondal, 2020), time that can instead be used for meaningful instruction.

The automated nature of RFID tracking improves data reliability and enables real-time analysis of attendance trends across courses, departments, and time blocks. This data can be used to support academic planning, identify students at risk of falling behind, and inform decisions about class scheduling and faculty assignments. It also provides students with transparent access to their own attendance records, reinforcing a sense of accountability.

Other colleges have seen improvements in student attendance and academic performance following similar implementations. By adopting this system, CCNY has the opportunity to gain similar positive outcomes, while also modernizing its infrastructure to better support both teaching and learning. In the long term, improved student engagement and institutional data insights can contribute to stronger student retention and resource allocation, ultimately supporting the college's mission and growth.

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