An RFID-Integrated Attendance System with Photo Verification for Classroom Efficiency

A Special Problem Proposal
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Abstract

The UP System started deployment of RFID/NFC-enabled UP ID in 2019. 5 years later, we have yet to see a system that fully utilizes the technology embedded in the UP ID. In particular, we see a great potential in using it as an access key for tracking the attendance of students in their classes. Professors currently either use the traditional pen and paper or a spreadsheet in their laptops to check for attendance. The mentioned practices are prone to forgery and takes precious time away from the class period.

Our paper proposes a fully digital attendance tracking system that can be used by professors to record the attendance of their students in real time. The system uses UP ID and facial recognition for a two-layer validation process ensuring accuracy of the records. Facial recognition uses a pretrained Facenet model that surpasses human beings in multiple facial recognition tests for accuracy. The proposed system allows the students to check in by aligning their face in the camera, and tapping their ID to the RFID/NFC reader. The current prototype takes only about 2-3 seconds per student to complete the whole validation and recording process, with more room for optimizations down the line.

Keywords: UP System, RFID, attendance, machine learning, facial recognition, Facenet model.

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Chapter 1

Introduction

1.1 Overview

Attendance plays an important role in improving academic performance of students. There is evidence that students who has lower attendance often has lower grades(Ancheta, Daniel, & Ahmad, 2021). That's why it is usually enforced and recorded for most institutions. However, the systems in place for recording are usually manual and time consuming.

The traditional pen and paper attendance system has existed since the invention of paper itself. It is used for time keeping by manually writing or checking the 'present' status in a paper log book. Manually writing names takes an average of 17 seconds per student (Shoewu, Makanjuola, & Olatinwo, 2014), and for class size of 30 students that leads to approximately 8 minutes wasted. While it is recognized that such system is time-consuming and wastes resources, it persisted because of it's familiarity. Going to class means bringing pen and paper for most students and teachers alike, so using the same material for recording attendance seemed the most practical.

In recent years, as laptops and portable computers became more accessible, some faculty of UP started transitioning to digital spreadsheets provided by services like Microsoft Excel. While it seemed to have moved the traditional pen and paper towards digitalization, another problem arises as this required manually roll calling students to say 'present'. It had the same problem of being a manual process. It is easily disrupted by a noisy class. Some time that was supposed to be utilized for immediate teaching was used for roll call.

Both systems mentioned are prone to errors and unnecessarily increases administrative burden for the faculty. Reduction in teaching time means frequently moving the lesson discussions by the faculty, with some topics being rushed or skip entirely by the end of semester. This reduces overall the quality of education students received and may negatively impact their readiness for subsequent courses they may take.

Therefore, we propose a fully automatic, digital attendance system that addresses these concerns. We utilize the already distributed UP ID and pretrained face recognition models that ensures an easy, accurate, attendance keeping. It aims to ease the burden of faculty and students from manual methods of attendace system, allowing them to focus on class discussions instead.

1.2 Problem Statement

The current methods of taking attendance today such as the manual call roll, biometrics, and online or remote attendance provides challenges in terms of efficiency, security, and authenticity. Manual roll calls are time consuming, according to (Mahato & Suman, 2013, p. 5875), it consumes an average of 5 to 15 minutes in order to complete an attendance using manual roll call attendance. It also provides a burden to some of the teachers through the disruptive behaviors of the students which lower the efficiency of manual roll call ("How Teachers Can Meet the Challenges," 2015). Biometrics attendance systems like fingerprint and facial scanning provide efficiency in taking an attendance but it is more costly and widely not accessible. The online or remote attendance system is only advisable in virtual class and not in face to face class as it is prone to attendance fraud.

Failure to resolve efficiency and a secured attendance system may lead to inaccurate attendance records and high risks of attendance fraud. These gaps may also affect the integrity in terms of attendance of the university. To fill those gaps, the solution should be the integration of RFID and facial recognition technology but there are uncertainties which are the efficient ways to integrate the real-time face capture while managing the privacy concerns and also finding an optimal way to gather sensitive information which are the student's biometric and their RFID serial number.

Given the gaps of the current attendance system method, there is a need to design an attendance system with the integration of RFID and facial recognition technology which are:

1. Efficiently captures the real-time data using the RFID and facial recognition technology.

2. Ensure and maintain security and privacy of the student's sensitive data such as their facial biometrics and unique serial number of their RFID.

3. Ensure compatibility with the university infrastructure which is the availability of RFID and the hardware for facial scanning.

4. Determine the effectiveness of the combination of the RFID and facial technology in the attendance system.

1.3 Research Objectives

1.3.1 General Objective

This subsection states the over–all goal that must be achieved to answer the problem. Address the following: Given your research challenge or opportunity, how do you intend to solve it? What is the output of your research?

1.3.2 Specific Objectives

This subsection is an elaboration of the general objective. It states the specific steps that must be undertaken to accomplish the general objective. These objectives must be **S**pecific, **M**easurable, **A**ttainable, **R**ealistic, **T**ime-bounded. Also, they are manageable and communicable.

A specific objective start with "to <verb>" for example: to design/survey/review/analyze.

Studying a particular programming language or development tool (e.g., to study Windows/Object-Oriented/Graphics/C++ programming) to accomplish the general objective is inherent in all thesis and, therefore, must not be included here.

1. To compare and contrast existing algorithms (on what problem?);

2. To develop a new algorithm (for what purpose?)

3. To analyze the algorithm (based on what criteria?)

1.4 Scope and Limitations of the Research

This section discusses the boundaries (with respect to the objectives) of the research and the constraints within which the research will be developed.

1.5 Significance of the Research

This section explains why research must be done in this area. It rationalizes the objective of the research with that of the stated problem. Avoid including sentences such as "This research will be beneficial to the proponent/department/college" as this is already an inherent requirement of all BSCS majors. Focus on the research's contribution to the Computer Science field.

The following are guide questions that may help your formulate the significance of your research.

- What is the relevance of your work to the computer science community?
  - What will be your technical contributions, in terms of algorithms, or approaches, or new domain?
  - What is your value-added compared to existing systems?
- What will be your contributions to society in general?
  - Who will benefit from your system?
  - Who are your target users and how will this system benefit them?

Chapter 2

Review of Related Literature

2.1 Importance of Attendance Tracking

Attendance has become increasingly important in every organization, institution, and workplace to ensure accountability, productivity, and engagement. For example, in schools, it ensures that students are present, participating, and fulfilling their responsibilities. Taking students' attendance is important for monitoring their performance in class. Good attendance is usually linked to good class performance, and vice versa (Zhi, Ibrahim & Aris, 2014).

2.1.1 Traditional Attendance Methods

The traditional method of taking attendance is through a manual roll call. According to Uniyal (2022), using manual attendance is cost-effective, simple to use, and remains functional during power interruptions. However, despite these advantages, manual attendance has several flaws such as time consuming like for the roll call method, according to (Mahato & Suman, 2013, p. 5875). An average of 5 - 15 minutes is wasted for manual roll calls which is a lot of time that will be consumed during class or work time. Another one is that there is no integrity when the ledger sheets are the method of taking attendance as there is a possibility to fake another student's attendance through forging another student's name and signature plus it is also easy for the student to replace and erase someone already there.

2.1.2 Biometric-Based Attendance Systems

The Biometrics - fingerprint filled some of the gaps in manual attendance. According to (Walia & Jain 2016), replacing the traditional way of taking an attendance to biometric fingerprint is a must as it fills the gaps in taking the manual attendance such as the roll call and paper based. The unique fingerprint of each person is a great idea to include in the field of attendance management. Even though a biometrics fingerprint attendance system is an ideal way to have validity, reliability, etc., there are still possible problems that may occur if we totally applied this way alone itself. According to (Truein, 2024), there is a possibility to have an issue in terms of the target's biometric recognition when the part of their finger they use to register to identify their fingerprint is wounded or injured as the current sensors are not capable to detect deeply within the wound plus dirty and dusty fingerprint may give the sensor a difficulty to analyze the person's fingerprints' biometrics. Deployment also might be expensive as mostly the biometric fingerprint attendance system relies on hardware and peripherals, in addition to that, since biometric fingerprint will be the attendance system, meaning it must be available to each of the rooms where attendance is needed plus it is not ideal to remote settings.

According to (Truin, 2024), there is another one that is more reliable and has a higher accuracy than the fingerprint biometric attendance system and that is facial recognition. According to (Yang & Han 2020), with the use of real time video processing, it can result in a high accuracy for about 82% which is higher compared to other attendance systems. It can also reduce the truancy rates in school as the facial recognition system can easily identify who gets in and out in real time, preventing the students from cutting classes or even skipping classes.

2.2 Theme 1 Title

This chapter contains a review of research papers that:

- Describes work on a research area that is similar or relevant to yours
- Describes work on a domain that is similar or relevant to yours
- Uses an algorithm that may be useful to your work
- Uses a software / tool that may be useful to your work

It also contains a review of software systems that:

- Belongs to a research area similar to yours
- Addresses a need or domain similar to yours
- Is your predecessor

2.3 Theme 2 Title

2.4 Chapter Summary

Should include a table of related studies comparing them based on several criteria.

Highlight research gaps and the research problem.

Chapter 3

Research Methodology

This chapter lists and discusses the specific steps and activities that will be performed to accomplish the project. The discussion covers the activities from pre-proposal to Final SP Writing.

3.1 Research Activities

This project aimed to create an automated attendance system with the help of RFID together with facial recognition technology. This attendance system will replace and reduce the usage of manual attendance such as the written and oral and enhance its lacking optimized features such as security, reliability, authenticity, and integrity using the student's RFID and facial biometric.

The proposed system is expected to function by tapping the RFID of the students with real time facial capture through face recognition technology. The identity of the students will be verified through the unique serial number of their RFID that will match from the system database while the face recognition will serve as the two-factor authentication. The face recognition is expected to work by capturing the students face then will be matched also through the system database. The attendance will only be valid once both student's unique serial number in their RFID and their face has been verified.

To make the system functional, several data from the students need to be collected. Those are the student's name, student number, student's unique serial number of their RFID, and their facial biometrics. Those data will be gathered either online or face to face. Students are encouraged to download any of the RFID

card readers to know their RFID's serial number but in case they are incapable of doing that. Face to face to face will be an option where we can provide a physical RFID card reader. The facial recognition data will be gathered through capturing their image or video to be more accurate.

The hardware components will be using in this system are: RFID scanner: Which will be used to read the RFID given to the students. This will also be responsible for taking the students unique serial number on their RFID ensuring the integrity of the students. USB connector: This will be used to connect the RFID scanner and the Camera Module to the Laptop or Raspberry Pi. Laptop / Raspberry Pi: This will serve as the main processing unit. The laptop or raspberry pi will be used for running the required algorithm to make the face recognition and read the RFID correctly. Overall, the laptop / raspberry pi will be in charge of handling the data. Camera Module: In charge of capturing the student's facial image while scanning the RFID to the RFID scanner. Software Python facial recognition

DO NOT FORGET to cite your references.

3.2 Calendar of Activities

A Gantt chart showing the schedule of the activities should be included as a table. For example:

Table 3.1 shows a Gantt chart of the activities. Each bullet represents approximately one week worth of activity.

Table 3.1: Timetable of Activities

Activities (2024)	Aug	Sep	Oct	Nov	Dec
Study on Prerequisite Knowledge			●●	●●●●	
Review of Existing Racing Strategies	●●	●●●●	●●●●	●●●●	
Identification of Best Features				●●●●	●●
Development of Racing Strategies				●●	●●●●
Simulation of Racing Strategies				●●	●●●●
Analysis and Interpretation of Results				●●●●	●●●●
Documentation		●●	●●●●	●●●●	●●●●

Chapter 4

Preliminary Results/System Prototype

This chapter presents the preliminary results or the system prototype of your SP. Include screenhots, tables, or graphs and provide the discussion of results.

References

Ancheta, R. F., Daniel, D., & Ahmad, R. (2021). Effect of class attendance on academic performance. *European Journal of Education Studies*, *8*(9). Retrieved from `https://oapub.org/edu/index.php/ejes/article/view/3887` doi: 10.46827/ejes.v8i9.3887

Shoewu, E. D. O., Makanjuola, N., & Olatinwo, S. (2014, 01). Biometric-based attendance system: Lasu epe campus as case study. , 8-14. doi: 10.12691/ajcrr-2-1-2

Appendix A

Appendix Title

Appendix B

Resource Persons

Mr. Firstname1 Lastname1
Role1
Affiliation1
emailaddr1@domain.com

Ms. Firstname2 Lastname2
Role2
Affiliation2
emailaddr2@domain.net

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