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| Date Stamp Required of the Department |

**NATIONAL INSTITUTE OF BUSINESS MANAGEMENT**

**HIGHER NATIONAL DIPLOMA IN SOFTWARE ENGINEERING**

**COURSEWORK**

**Internet of Things**

**IoT based Smart Attendance System**

**SUBMITTED BY**

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**Date of Submission:** 24th of May 2025

**Abstract**

With the technological advancement in the modernized world, the manual process has been subjected to be automated to increase accuracy, efficiency and performance. Among those attendance checking in educational organization has been discussed throughout this report when it comes to the Ayotte based smart attendance system. It is implemented as a result of an increase in the rate of proxy attendance checking which also has been a reason to reduce academic performance and also affected the safety of students as well.

The mentioned IoT-based smart attendance system includes 3 verification methods which are QR code fingerprint and face recognition. The motion sensor which is integrated with the system automatically triggered to power on status when it detects a user and it requests the QR code. The secular code matches the session it requests for the biometric verification, either the face recognition or the fingerprint allows user to check the session time using real time clock and GPS. All the data will be stored in firebase and displayed in web application as well the teacher can track students attendance and the real time location using this application.

By implementing this system, the fraud attendance checking is minimized, and the teacher also will be aware of students’ records as well.

**Acknowledgement**

We would like to express my gratitude to my make sure Mr. Bhathiya Seneviratne who guided me to implement this IoT-based attendance management system by giving the needed instructions and support. Also, I would like to express my thanks to all the open-source platforms which gave us knowledge about IoT concepts and implementation guidance. We would appreciate the online tools which facilitated the project by providing the essential libraries, and tools to enhance our academic and practical experience. And we hereby make this an opportunity to thank our parents and peers for their support given to complete this project as well. The collaboration and teamwork between our team members was the backbone of the successful completion of the project. Finally, we heartfully thank our educational institute NIBM School of Computing, which gave us the opportunity to spend our valuable academic experience in IoT concepts by providing laboratory experience.

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# Literature Review

An attendance management system in an educational organization stands for collecting student records who attended a relevant session. As the manual systems were not sufficient for maintaining efficiency and the accuracy of the process, many automated systems were introduced by many researchers and scientists.

When considering the recent research of researchers, Chiang et al. (2022) has implemented and android mobile based attendance checking system using GPS NFC near field communication technologies in order to track the presence of students in classrooms. (Chiang et al., 2022). As per Thejas et al. (2024), has explained the limitations of manual attendance tracking by emphasizing the need for an automated attendance checking. The selected research report has also encouraged researchers and scientists to discuss and find solutions to this problem as well (Thejas et al., 2024). Vismitha P Y (2022) also mentioned about an automated attendance monitoring system which can be used during the Covid pandemic considering health and hygiene of students. It focused on marking attendance during Microsoft team sessions (Vismitha P Y et al., 2024).

But none of the study focused on multiple options to manage the attendance to ensure the availability of services even in breakdown in some system functions. But our proposed systems mentions the strategies to implement the system even when some features are under breakdowns.

# Introduction

## 1.1 Problem Statement

Current attendance checking systems used in educational institutes are most of the based on manual checking strategies using human power which may cause errors while consuming much time as well. With the evaluation of technology, some of the institutes have shifted towards single more authentications such as fingerprint, RFID, card swipes and manual sign-ins. Even though the some of above include automated systems, they lack features such as data backup, real-time monitoring, multi-level verification. Those still create gaps to involving fraud in attendance which affects the academic performance of students while not obeying the rules of the institution using disciplinary actions. Moreover, they are not still reliable when considering factors such as sensor failures and hygiene-based concerns as well. These problems related to attendance checking and monitoring of students should be called with relevant measures as soon as possible in order to fix the performance and safety of students and the organization.

## 3.2 Solution

As the solution for this problem, we have proposed a “IoT based Smart Attendance System” which include the following features to overcome above-mentioned problems while increasing the user engagement.

The system has been planned to implement with 03 ways to mark the attendance of students.

* Via QR code scanning system
* Face Recognition system
* Fingerprint attendance record system

All the above systems are planned to embed in a single system for giving the user the best experience. Each student gets a unique QR code to scan using their phone, or they can stand in front of **ESP32-CAM** or use the fingerprint scanner to record the attendance. When the attendance is marked the real-time clock is recorder with the index of the student and session attended. Those data are saved in a database, and for the backup purpose data stores in a google sheet and SD card as well. Also, the GPS tracker tracks the position of the student as well. The whole process is managed by the web application which is managed by the teacher. This solution will avoid fraud attendance marking in institutes.

## 1.3 Objective

The objective of this product is to minimize the fraud attendance marking by students which affected their performance also to ensure that the students are maintaining proper attendance for the lecture series. The system should satisfy the user by enhancing the accuracy and security of data as well. The multi-choice system also ensures the availability of the system in case of system breakdown as well while saving the time.

# System Design and Architecture

## 3.1 Hardware Components

The proposed “IoT based Smart Attendance System” requires following main components in order to fulfil the required functionalities.

* ESP32-CAM – as the face recognition tool
* NodeMCU ESP8266 WiFi ESP-12E CH340 IoT Dev Board Module – to handle QR codes scanned from mobile devices
* NEO-6M GPS Module – get the GPS location support
* DS3231 RTC Module – to get the accurate clock time
* FT232RL USB to TTL Converter Module Adapter Mini USB (MD0128) - to upload the code to camera
* PIR Motion Sensor – to automatically power on the system when a user is detected
* SD cards – for data backup
* Fingerprint sensor module – to collect fingerprint input
* Smartphone – to scan the
* WIFI Router – to get the internet access

Other than these required components will be mentioned in the bill of materials.

## 3.2 Hardware Components

The Following software are needed in order to run the IoT based smart Attendance system.

* Arduino IDE – To upload the code to ESP32 CAM and NodeMCU ESP8266
* QR code generator – to generate QR codes for scanning
* GitHub – Version Control purpose

Other than the above-mentioned software requirements the following are needed to implement the web application which is used to manage the system. The web application will be managed by the teacher in order to manage and manipulate collected data and used to view the real-time location verification of the students in classroom premises as well. The application is also used to activate and deactivate relevant features in order to save power and to enhance the user friendliness other than the motion sensor. The following is the tech stack used.

* Frontend – HTML, CSS, JS
* Backend – Firebase Database
* Database – Firebase Database

The integration of above-mentioned tech stack will enhance the efficiency of smart attendance system.

## 3.3 Bill of Materials

|  |  |  |  |
| --- | --- | --- | --- |
| **Component** | **Quantity** | **Amount (Rs)** | **Total (Rs)** |
| NodeMCU ESP8266 WiFi ESP-12E CH340 IoT Dev Board Module | 1 | 800 | 800 |
| PIR Motion Sensor | 1 | 230 | 230 |
| NEO-6M GPS Module | 1 | 1100 | 1100 |
| DS3231 RTC Module | 1 | 370 | 370 |
| Breadboard | 1 | 130 | 130 |
| Jumper Wires | 1 pack | 1000 | 1000 |
| USB Cable (For ESP/TTL module) | 1 | 380 | 380 |
| QR Code Printouts | 10 | 10 | 100 |
| WIFI Router | 1 | 2500 | 2500 |
| LED | 2 | 50 | 100 |
| Buzzer | 1 | 200 | 200 |
| SD Card Module (Optional) | 1 | 200 | 200 |
| SD Card | 1 | 1000 | 1000 |
| Power Supply Adapter | 1 | 890 | 890 |
| Small Screws | 10 | 5 | 50 |
| Heat Shrink Tubing | 1 pack | 280 | 280 |
| Electrical Tape/black tape | 1 roll | 200 | 200 |
| Cable Ties | 10 | 5 | 50 |
| Soldering iron | 1 | 700 | 700 |
| Capacitors | 10 | 10 | 100 |
| FT232RL USB to TTL Converter Module Adapter Mini USB (MD0128) | 1 | 420 | 420 |
| ESP32-CAM | 1 | 1950 | 1950 |
| AS608 Fingerprint sensor module | 1 | 2750 | 2750 |
| Nuts and Bolts | 10 sets | 10 | 100 |
| Plastic Mounting Board | 1 | 330 | 330 |
| Glue Sticks | 6 | 40 | 240 |
| Glue Gun | 1 | 720 | 720 |
| Nuts | As requires | 100 | 100 |
| Soldering Iron | 1 | 790 | 790 |
| Soldering Wire | 01 role | 120 | 120 |
| Soldering Iron Stand | 1 | 490 | 490 |
| Scissor | 1 | 150 | 150 |
| Glue (normal) | 1 | 115 | 115 |
| Bristol Board | 1 | 55 | 55 |
| Super Glue | 1 | 95 | 95 |
| Multimeter | 1 | 700 | 700 |
| Paper Cutter | 1 | 200 | 200 |
| Double Tape | 1 | 750 | 750 |
| Plier | 1 | 1470 | 1470 |
| Resistors | 01 pack | 50 | 50 |
| Other |  |  | 200 |

|  |  |  |  |
| --- | --- | --- | --- |
| **Total Amount** |  |  | **Rs 22175.00** |

# Methodology

The completed methodology and the process flow is shown in the format of a flow chart as follows.

A diagram of a flowchart

AI-generated content may be incorrect.

# Implementation

Assembling the system can be done in few phrases such as face recognition, QR code attendance, and fingerprint scanner. The tinker cad circuit diagrams will be explaining the integration of components.

A circuit board with wires

AI-generated content may be incorrect.

# TimeLine

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Phases | Week  01 | Week  02 | Week  03 | Week  04 | Week  05 | Week  06 |
| Research and Feasibility Study |  |  |  |  |  |  |
| Concept Design and Planning |  |  |  |  |  |  |
| Prototyping the Hardware |  |  |  |  |  |  |
| Coding the robot |  |  |  |  |  |  |
| Testing the functions |  |  |  |  |  |  |
| Debugging the errors |  |  |  |  |  |  |

1. Research and Feasibility Study

Research about the relevant hardware components to implement the robot.

1. Concept Design and Planning

Gathering all those hardware components and make the connection in between them.

1. Prototyping the Hardware

Creating an outer cover with relevant hardware components to depict the shape of a pet with additional hardware components and connections.

1. Coding the robot

Choosing a programming platform and program the robot according to the functions needed.

1. Testing the functions

Run the robot and identify its errors and areas to improve.

1. Debugging the errors

Debug and modify the robot with relevant modifications.

# References

Te-Wei Chiang, Cheng-Ying Yang, Gwo-Jen Chiou, Frank Yeong-Sung Lin, Yi-Nan Lin, Victor R. L. Shen, Tony Tong-Ying Juang & Chia-Yang Lin (2022) Development and Evaluation of an Attendance Tracking System Using Smartphones with GPS and NFC, Applied Artificial Intelligence, 36:1, 2083796, DOI: 10.1080/08839514.2022.2083796

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# Appendices