Effortless Attendance Tracking with Object Detection and Bluetooth Low Energy

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Abstract - Bluetooth Low Energy (BLE) technology has revolutionized the way devices communicate wirelessly over short distances. BLE has found its application in many fields, and one such innovative use case is the Automatic Attendance System. This system is a game-changer in the educational sector as it allows for the efficient tracking of student attendance.

The Automatic Attendance System consists of two main components, a Bluetooth card, and a BLE receiver. Every student is provided with a Bluetooth card that is attached to their mobile phone, and a BLE receiver is installed in every classroom. When a student enters the classroom, the BLE receiver detects the Bluetooth MAC ID of their phone and automatically records their attendance in a local database. This process is completely automated and requires no manual intervention, making it a hassle-free experience for both students and teachers.

The system also provides real-time attendance monitoring, which means that teachers can keep track of the attendance of their students as it happens. This feature eliminates the need for manual attendance-taking, freeing up valuable time for teachers to focus on more important tasks. Additionally, the system generates reports that can be emailed to faculty members for further analysis. These reports can help faculty members identify patterns in attendance and devise strategies to improve attendance rates.

The Automatic Attendance System is a cost-effective solution that can benefit educational institutions of all sizes. By leveraging the power of BLE technology, this system can efficiently track student attendance, save time, and improve the overall educational experience. Moreover, the system can be further enhanced by integrating artificial intelligence systems into the cloud database. This integration would allow for additional features such as facilitating OD and Outpass requests for students, making the system even more versatile and useful.

***Key Words*: IoT , Attendance system , Artificial Intelligence , BLE.**

1.INTRODUCTION

The regular monitoring of attendance is another obligatory task of faculties in every university which costs them valuable teaching time in their lectures.The attendance plays an important role when it comes to applying university criteria of 75% attendance for exam eligibility and smooth monitoring of colleges. The Attendance system should consider following things while marking the present students:-

● The student should be present throughout the lecture hours.
● No Proxy or false attendance should be marked.
● Any error or special case should be tractable and corrected easily.

And this all is achieved in hereby methodology by using Bluetooth addressing for unique identification and tracing of students in class. The Students don't have to use any extra chips or tags with their phone or ID card. Simply the Bluetooth of the phone and its unique address will be used for marking the attendance. This system will also use a double check method for tracing the present students to avoid any False Attendance from getting marked. The method mentioned here proves to be better as no use of excess identification tags/cards is required

2. LITERATURE SURVEY:

[1] Automated Attendance Management and Alert System. S.K.N.A.Rahim, N.R.P.Ismail, F.A.Razak, I.Z.Zulkifli, N.H.Jamian, N.F.Razi and N.H.Mohammad.
The AAMAS system was created to assist UiTM lecturers

and the Academic Affairs Department by providing various functions, including managing and recording students' attendance records and sending automatic alerts to students with high absenteeism via SMS and email. The system also tracks the number of alerts sent.

[2] Study of Implementing Automated Attendance System Using Face Recognition Technique. Nirmalya Kar, Mrinal Kanti Debbarma, Ashim Saha, and Dwijen Rudra Pal. This paper presents a method for automatically recording students' attendance in the classroom environment using face recognition technology and the PCA algorithm. The system logs the clock-in and clock-out time of students, and the faculty can easily access this information.

[3] Automatic Attendance System Using Deep Learning. Sunil Aryal, Rachhpal Singh, Arnav Sood and Gaurav Thapa. In this paper, a new automatic attendance system is proposed that uses machine learning and deep learning algorithms with real-time face recognition technology. The system integrates with existing university management systems and aims to be less time-consuming than the traditional manual attendance system.

[4] Automatic Attendance Management System. Suman Dey ,Ankur Guha, Dibyarup Basu, Sudipta Banerjee. Monitoring and analyzing classroom activities using machine learning can help teachers evaluate the attentiveness and performance of students. This monitoring process helps students acquire quality education and identifies disruptive students, increasing the effectiveness and fruitfulness of classes.

[5] Automated Attendance System Using Image Processing. Pooja.G.R, Poornim.M, Palakshi.S, M.Bhanu Prakash Varma, and Krishna.A.N. This system is based on face detection and recognition algorithms and automatically marks attendance by recognizing the student when they enter the classroom using a webcam. The paper describes the system architecture and algorithms used and proposes techniques to handle spoofing threats.

[6] Online Attendance System. A. Babu Karuppiah,R. Raja Raja, M. Jeyalakshmi, L. Johnsilin Shiny, and B.Sri Devi. This paper introduces a new approach to automatic attendance management systems that integrates computer vision algorithms with real-time face detection. The system uses machine learning algorithms combined with adaptive methods to track facial changes during a longer period of time and represents a supplemental tool for instructors.

[7] Automated Attendance and Monitoring system using Machine Learning. Sanjana Mekala, Sai Bhavyasree Vootla, Vishnu Vandana Pyatla, Ashwini Ambigalla, and Mareswara Rao Y. This study describes a face recognition-based attendance checking system for educational institutions. The system identifies students' faces and updates their attendance in an Excel sheet. Students who are present in class for a specified period of time are rewarded attendance, and the entire database is uploaded to the cloud.

[8] A Development of an Online Student Attendance Management Information System. Marcel, Flaubert. The new online attendance management system is designed to speed up the daily attendance process efficiently and cost-effectively, with a user-friendly interface and enriched modules.
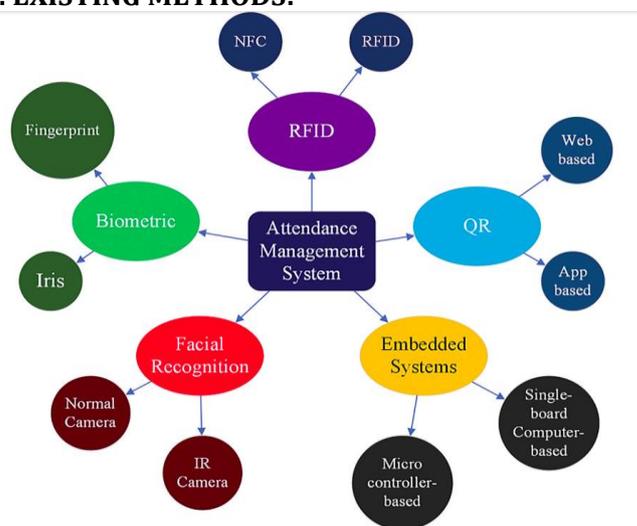
3. EXISTING METHODS:

Fig-1

Automated attendance systems have become an integral part of many workplaces and educational institutions as they help to streamline attendance tracking, save time, reduce errors and eliminate manual record keeping. There are several existing methods for automatic attendance systems, and each method has its own set of advantages and disadvantages. In this context, we will explore the different workflows of the automated attendance system.

Biometrics - One of the widely used methods of the automated attendance system is the biometric system. It uses biometric sensors to mark attendance by pressing our thumb impression on the sensor. While this method has proved to be effective in workplaces, it can cause delays and increase the queuing system in educational institutions, especially when several students need to mark their attendance simultaneously.

RFID/ NFC Technologies - Another commonly used method for automated attendance is RFID/NFC technology. In this system, each employee or student would be given an RFID tag or card, which would be encoded with their unique ID number. The tag would be attached to their clothing or badge, and when they enter the workplace or classroom, the RFID reader would scan their tag and record their attendance. Although this method is effective, it can fail when there are dozens of people entering the workspace or

classroom at the same time.

Facial Recognition - Facial recognition technology is also a promising method for creating an automated attendance system. It uses facial recognition algorithms to detect and identify faces in an image or video. After the face is identified, the system can compare it with the database of registered faces to determine if the person belongs to an employee or student. If a match is found, the system can then log the attendance and update the employee or student's records. This method can significantly reduce paperwork, save time, and reduce errors in attendance tracking.

In conclusion, each method of the automated attendance system has its own advantages and disadvantages, and the choice of a particular method will depend on various factors, such as the size of the organization, the number of employees or students, the nature of the workplace, and the available technology. Nevertheless, automated attendance systems have proved to be efficient, accurate, and convenient for tracking attendance, reducing errors and saving time.
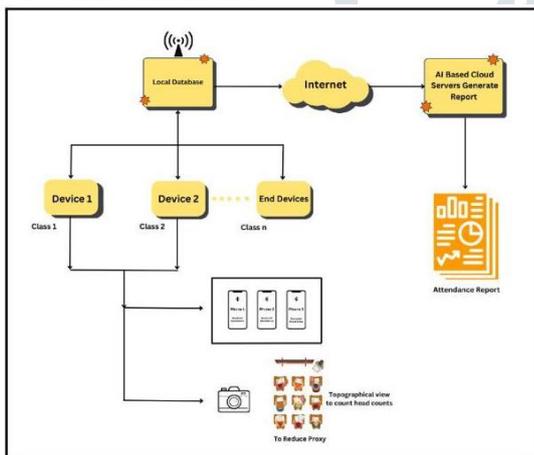
4. PROPOSED METHOD:

Fig - 2

4.1 Working:

The implementation of these cutting-edge devices has significantly transformed classroom management. Every classroom is equipped with these devices, which enable staff members to enter essential details such as classroom and course information with ease. To begin the attendance process, students are required to enable their Bluetooth feature on their mobile devices.

Once the "START SCANNING" button is pressed, the scanning process begins. These innovative devices fetch every Bluetooth MAC address and their corresponding register numbers inside the classroom. The scanning process for a class of 60 students takes only 3 to 5 minutes, depending on the efficiency of the process. After the scanning is complete, the students' register numbers appear on the device's touchscreen. If a student is absent due to an on-duty assignment, a checkbox is available to

mark them as present.

Once the attendance process is complete, the device transfers the data fetched to the local database, which can be used for further analysis and tracking. These information and details are transferred to the AI Based Cloud Servers which helps to organise the data and is very easy to fetch specific data like course attendance and class attendance.

To reduce proxy a topographical view camera can be used to count headcounts in a class, which can significantly reduce proxy attendance. A topographical view camera is a type of camera that can capture images of a particular area from a bird's eye view. It is designed to capture panoramic views of a space, and its images are accurate and detailed. This camera can be installed in a classroom or any other space where attendance tracking is necessary. Once installed, the camera can provide a topographical view of the room, which can be analyzed to count the number of people present.

The topographical view camera can detect the presence of a person through a headcount system. The camera can be calibrated to identify the size of the head and the body to ensure that it only counts people and not other objects in the room. Once the system detects a person, it will mark them as present, and their attendance will be recorded automatically. This eliminates the need for manual attendance tracking, which can be time-consuming and prone to errors.

One of the primary advantages of using a topographical view camera to count headcounts is that it significantly reduces the likelihood of proxy attendance. Proxy attendance occurs when an individual marks themselves present using an ID card or a manual attendance sheet, even if they are not actually present. This can happen if an individual asks a friend to mark them present or if they leave the class early and mark themselves present later. With a topographical view camera, there is no room for proxy attendance. The camera will only mark a person present if they are physically present in the room.

This innovative technology has significantly reduced the time and effort required to take attendance, giving teachers more time to focus on teaching and improving the learning experience for their students.
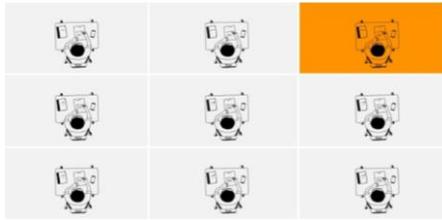
Fig - 3

The above Fig - 3 displays the number of students present, which was determined through object detection to cross-check with the Bluetooth MAC addresses.

5. HARDWARE

5.1 TFT Display:
One accessory that can enhance the Raspberry Pi experience is the TFT Display. It is perfect for DIY enthusiasts who want to work on their projects anytime and anywhere without the need for a separate power source or case. The TFT Display sits right on top of the Raspberry Pi and is a perfect solution for HDMI observers. The screen also comes with a stylus for easy interaction with the display.

5.2 Raspberry Pi:
A battery pack is a useful accessory for Raspberry Pi projects, and any portable battery that can charge a smartphone over USB can be used with the Raspberry Pi. A 4000mAh battery pack is a recommended choice as it provides 5V 2.4A output and includes a nano adhesive pad that can stick to most surfaces. It is designed to work with Raspberry Pi 4 and has a built-in USB-C cable that powers your Pi. The battery pack can be recharged with either a USB-C or micro USB cable, and a micro USB version is also available for older Pi models.

5.3 Battery Pack for Raspberry Pi
In addition to powering the Raspberry Pi, this battery pack can also double as a smartphone or tablet charger. It can be charged while providing power to your device, making it the perfect all-round portable battery for your favorite tech. Whether you are working on a project or traveling, the TFT Display and Battery Pack are great accessories to have for your Raspberry Pi.

6. SOFTWARE

6.1 Raspbian OS:
Raspberry Pi OS, formerly known as Raspbian, is a Unix-like operating system based on the Debian Linux distribution. It was first developed independently in 2012 and has been the primary operating system for Raspberry Pi boards since 2013. It is distributed by the Raspberry Pi Foundation.

6.2 Visible Studio Code
Visual Studio Code is a source-code editor that supports a variety of programming languages including Python, Java, C++, and JavaScript. This platform is often used to develop artificial intelligence projects.

6.3 Fast API:
FastAPI is a Python-based web framework for building efficient APIs. FastAPI utilizes Pydantic and type hints for data validation, serialization, and deserialization, and also generates OpenAPI files automatically. FastAPI fully supports asynchronous programming and can run with Gunicorn and ASGI servers, such as Uvicorn and Hypercorn. To improve developer-friendliness, editor support has been considered since the early stages of design.

6.4 Pandas:
Pandas is a software library written in Python, primarily used for the analysis and manipulation of data. The library offers various data structures and functions to process and handle numerical tables as well as time series data. It is released under the 3-clause BSD license and is freely available for use.

6.5 custom Tkinter
CustomTkinter is a UI-library for Python that utilizes Tkinter as its foundation, offering a set of contemporary and fully customizable widgets. These widgets can be created and used like regular Tkinter widgets, and they can also be combined with regular Tkinter elements. The widgets and window colors automatically adapt to the system appearance or manually set mode, such as 'light' or 'dark', and support HighDPI scaling on Windows, macOS, and Linux. With CustomTkinter, developers can achieve a consistent and modern look across all desktop platforms.

6.6 Google Gmail Mail:
The Gmail API is a RESTful API that allows access to Gmail mailboxes and sending mail. It is the best option for legal access to a user's Gmail data and is suitable for various applications, such as read-only mail extraction, indexing, and backup, automated or programmatic message sending, email account migration, and email organization such as filtering and sorting of messages.

7. RESULT

column 1	column 2	column 3	column 4	column 5	colu...
Date	Time	19EC064	19EC066	19EC067	19EC0...
11.12.2022	13:01:06	1	0	0	0
11.12.2022	18:33:36	1	0	0	0
12.12.2022	10:23:13	1	0	0	0
12.12.2022	10:23:52	1	0	0	0
12.12.2022	16:00:41	1	0	0	0

Fig - 4

Fig -5

Fig - 6

Fig - 7

8. CONCLUSION AND FUTURE WORK:

The use of BLE technology for automatic attendance system is a promising solution for

educational institutions. It has several advantages, including cost-effectiveness, convenience, and accuracy. It also provides a secure platform as it uses encrypted data transmission. Moreover, it eliminates the need for manual attendance, which is a tedious task. Overall, BLE technology can be effectively utilized to create an effective and efficient attendance tracking system.

Some of future work we would like to add are:
● Creating the Attendance Portal which as both User and Admin Interface
● Adding a feature call availing for On Duty and outpass form with that portal
● Deploying a synced local and cloud database for security and data reliability.

9. REFERENCE:

[1] Automated Attendance Management and Alert System. S.K.N.A.Rahim, N.R.P.Ismail, F.A.Razak, I.Z.Zulkifli, N.H.Jamian, N.F.Razi and N.H.Mohammad.

[2] Study of Implementing Automated Attendance System Using Face Recognition Technique. Nirmalya Kar, Mrinal Kanti Debbarma, Ashim Saha, and Dwijen Rudra Pal.

[3] Automatic Attendance System Using Deep Learning. Sunil Aryal, Rachhpal Singh, Arnav Sood and Gaurav Thapa.

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[5] Automated Attendance System Using Image Processing. Pooja.G.R, Poornim.M, Palakshi.S, M.Bhanu Prakash Varma, and Krishna.A.N.

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