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DRONE WITH ATTENDANCE MONITORING IN CLASSROOM

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ABSTRACT:

This project leverages advanced machine learning techniques and drone technology to enhance surveillance within academic environments. A drone equipped with a camera captures images of individuals and sends them to a machine learning model that has been pre-trained on a dataset containing personal details such as images, roll numbers, and names. The system compares the captured images with the stored data to identify individuals. If a match is detected and the person is found outside their designated classroom during class hours, the system automatically notifies the respective class teachers. This innovative approach demonstrates the effective use of machine learning and drones as tools for real-time monitoring. This project leverages machine learning techniques to enhance surveillance and ensure compliance within academic institutions.

I.INTRODUCTION:

Recording students' attendance takes a lot of time each class period at educational institutions. Furthermore, due to the typical number of students in a batch, it takes a long time to record each student's actual attendance time, and such information is frequently inaccurate [1]. Nevertheless, recording student attendance is a common practice in many schools and universities, especially for those that implement a mandatory attendance policy [2,3,4]. In particular, attendance in class at all levels of education is given a lot of weight in Thailand's educational system. At the undergraduate level, such as for science or engineering, the policy enforces a minimum of 80% attendance for a particular course or laboratory to permit students to write an end of term examination [5].

Prior research [6] shows a strong relationship between regularity in classroom attendance and academic performance. Therefore, institutions enforce a policy of recording student attendance in classrooms, which instructors manually perform. However, this traditional process of attendance recording suffers from drawbacks and is prone to errors. Various technologies have been used to create systems that automate this process in classrooms to save time on relevant instruction and increase the reliability of attendance reports in recent years. The biometric systems [7,8] have been widely proposed, but they still have limitations in terms of the cost of installation and the time-consuming process of attendance registration.

Through connected sensors and devices, technology must serve to create an innovative learning environment and enhance learning activities in this scenario [9]. Therefore, technology must be used to facilitate the growth of student potential and to unburden the teachers from time-consuming manual activities. Bluetooth, owing to its low power consumption and cost [10], is the most commonly used radio frequency (RF) technology

for automatically capturing the actual time of students' attendance [11]. Additionally, because it is one of the most widely used technologies in wireless headsets, wearable devices, and mobile phones, it is an on-demand platform that anyone can use anywhere. In this study, we propose the system as a framework for an indoor positioning technology class attendance system. By determining the relationship between the mobile phone's position and the RSSI, Bluetooth Low Energy (BLE) technology was utilized for indoor location tracking. Due to boundary conditions, reflections, and walls, it is not possible to directly use an error model for free-field propagation in indoor environments, so this is difficult to calculate [12]. Our approach is based on the fingerprinting algorithm, combined artificial neural networks (ANN) with the radial basis function (RBF). Position calculations and attendance records are performed by the server. In a closed environment like a classroom, the system automatically collects signals from users' smartphones and uses them in the following real-world scenarios:We record the attendance of students with their positions in the classroom using our proposed system.

We store all of the gathered information in a database and display it in a web application each course (including calculations for absence or late attendance, per week, and per term).

II.RELATED WORK

2.1. Class Attendance

We look at relevant research on class attendance and technologies used in class attendance recording systems in this section. As was discussed in the preceding section, attendance in class is crucial to academic success. There is a positive correlation between class attendance and academic performance in a large dataset examined by Stanca [13]. Moreover, Quantile Regression Analysis [14] demonstrates the negative impact of class absence on academic performance.

Utilizing near-field communication (NFC) or RF identification (RFID) technologies is one method for developing class attendance systems. For instance, Nippon Systems Development's [16] study used RFID technology in an attendance system by developing a Java application specifically for this purpose. This particular application builds links among data collected from RFID devices to automatically register attendance and record entries into the database. In most cases, students' identity cards include special RFID tags. As a result, students are required to show and scan their student IDs through a reader. However, one drawback of this method is that identity cards can be used by anyone. As a result, for the purpose of recording the student's attendance, it is not sufficient to verify the student's identity. Students are required to scan their cards over the NFC tag on their smartphones that contains the student's picture in the research conducted by Ichimura et al. [17]. Class Attendance Management System (CAMS) prototype has been developed and introduced by Mohandes [18]. Using an NFC (or RFID) tag or card and a mobile device with Near-field communication (NFC) technology enabled, CAMS evaluates attendance. The known drawback for the class attendance system using NFC or RFID is that it requires additional preparation and equipment installation.

As a technology for short-range communication between network nodes, BLE has recently received a lot of attention from researchers. It has also been studied for its potential in classroom attendance systems. Bhalla et al. created a student attendance system in 2013 that used RFID and Bluetooth. [19]. The class assistant or professor can then view student attendance using a desktop or laptop connected to the system. In this system, student information is first collected through an RFID reader. Lodha et al. [20] created a Bluetooth-enabled attendance management system application in 2015. Their system requires Bluetooth electronic tags that can be embedded into student ID cards. Students no longer have to display their cards in front of a reader with this system because it works with a wireless network and utilizes Bluetooth technology, which reduces waste and increases productivity. A method that makes it easier for teachers to keep track of their students' attendance in the classroom was developed in 2016 by Apoorv and Mathur [21]. The students need to bring their student ID card (which has e-stimote [22] sticker beacons attached) to the classroom, and the system uses BLE beacons planted in the classroom to

detect the student identity and attendance. The application on an Android device that connects to the BLE beacon and collects sensor data still requires the teacher to manually extract attendance data. Some attendance systems require the installation of an application on students' mobile devices to gather attendance information. In 2016, Saraswat and Garg [23] developed an application using beacons for faculty admin tasks. This system directly notifies and interacts with students via web links and an application. In addition, the system automatically collects information about students' attendance during class based on where they are in the classroom. When the student is close to the beacon (near and immediate), the system runs a clock timer in the background of the application. The computation in this system is primarily performed on the student's smartphone. This requires a significant amount of processing on the student's mobile phone. Additionally, a system of this kind has the inherent drawback of requiring the student to install and maintain an additional application. Numerous previous methods for recording classroom attendance necessitate either the installation of additional applications by students or the use of additional equipment like NFC or RFID. By making use of indoor localization methods, we decided to make use of equipment that was already in place in our proposed system in order to cut down on operational expenses and complications. Fingerprinting

There are two steps in the fingerprinting procedure [27]. First, a vector containing all of the RSSI values at the reference point is gathered from predetermined locations throughout the classroom. The device's RSSI value is then picked up by the receiver. At this point, the RSSI vector is compared with the RSSI vector previously recorded, and location estimates can be calculated by a variety of algorithms. It is possible to use fingerprinting in classroom settings because it takes into account the different RSSI values. This technique is used in an improvement of the RSSI collecting process as well as the overall accuracy by taking into account the device proximity, device movement, and temporal sampling.

III.PROPOSED METHODOLOGY:

The "Drone for Attendance Head Count" project's proposed system transforms conventional approaches to classroom attendance tracking by combining sophisticated drone technology with cutting-edge computer vision algorithms. At its core, the system is designed to streamline attendance management processes in educational settings through the seamlessintegration of autonomous navigation, object detection, data processing, real-time reporting, and user interface functionalities. The system autonomously traverses classroom spaces using the cutting-edge capabilities of drones equipped with cutting-edge computer vision algorithms like YOLOv4, meticulously identifying and counting individuals in real time with unparalleled accuracy. Not only does this precision guarantee the accuracy of attendance records, but it also alleviates the administrative burden of manual tracking methods. Through user-friendly real-time reporting features, educators and administrators can access up-to-the-minute attendance data that has been meticulously processed to remove irrelevant information from the captured attendance data. Furthermore, the user-friendly interface enhances accessibility and usability, facilitating seamless integration into diverse educational environments. The proposed system has far-reaching advantages, including enhanced flexibility and scalability, proactive monitoring capabilities, and privacy-preserving measures, in addition to its immediate advantages. The project aims to create a more effective, inclusive, and student-centered learning environment by embracing technological innovation. This will lay the groundwork for future developments in educational technology. However, ongoing refinement and optimization efforts are essential to realize the full potential of the system and ensure its seamless integration into educational workflows.

IV.MODULES

Drone Navigation Module: The Drone Navigation Module serves as the foundational element of the "Drone for Attendance Head Count" project, orchestrating the precise movement and positioning of the drone within the classroom environment. This module integrates a sophisticated array of sensors, including GPS, accelerometers, and gyroscopes, to enable autonomous navigation and flight control. Leveraging advanced algorithms such as simultaneous localization and mapping (SLAM), the module enables

the drone to create a real-time map of its surroundings, identify obstacles, and navigate dynamically through the space. Through precise control and coordination, the Drone Navigation Module ensures optimal coverage of the classroom, allowing the drone to capture attendance data from every corner with accuracy and efficiency. By continuously monitoring its position and adjusting its flight path as necessary, the module guarantees seamless operation even in complex or crowded environments, providing educators and administrators with reliable attendance tracking capabilities.

Fig -2: Drone Navigation Module

Object Detection and Counting Module: The Object Detection and Counting Module forms the core functionality of the attendance tracking system, employing cutting-edge computer vision algorithms to identify and count individuals within the classroom environment. Leveraging advanced deep neural networks (CNNs), the module analyzes live video streams captured by the drone's onboard camera in real-time. By detecting and recognizing human forms or distinctive features, the module accurately determines the presence of individuals and assigns them to the attendance count. Furthermore, sophisticated object tracking algorithms enable the module to maintain continuity in counting even asindividuals move within the frame, ensuring precise and reliable attendance data collection under varying conditions. Through continuous refinement and optimization, the Object Detection and Counting Module delivers unparalleled accuracy and efficiency, providing educators and administrators with invaluable insights into student attendance patterns and behaviors.

Data Processing Module: The Data Processing Module serves as the central hub for processing and organizing the raw attendance data collected by the drone, transforming it into actionable insights for educators and administrators. Upon receiving the data stream from the Object Detection and Counting Module, this module employs a series of algorithms and data processing techniques to clean, filter, and validate the attendance data. Through rigorous data validation procedures, the module identifies and rectifies any discrepancies or anomalies, ensuring the integrity and accuracy of the attendance records. Furthermore, the module may perform advanced data analytics and visualization techniques to extract meaningful patterns and trends from the attendance data, enabling stakeholders to gain deeper insights into student attendance behavior. By streamlining the data processing pipeline and automating tedious manual tasks, the Data Processing Module empowers educators and administrators to make informed decisions and interventions based on reliable attendance data.

Real-Time Reporting Module: The Real-Time Reporting Module provides educators and administrators with instantaneous access to attendance information, facilitating informed decision-making and proactive intervention strategies. Through a user-friendly dashboard or interface, this module presents attendance data in a visually intuitive and easily interpretable format, enabling stakeholders to monitor attendance trends and identify areas of concern promptly. Key metrics such as total attendance count, individual student presence, and attendance trends over time are displayed dynamically, allowing educators and administrators to track attendance patterns and behaviors effectively. Moreover, the module may support customizable reporting options, enabling users to generate attendance reports tailored to their specific needs or requirements. By providing real-time insights into student attendance, the RealTime Reporting Module empowers educators and administrators to implement targeted interventions and support measures, ultimately fostering a more positive and inclusive learning environment.

V.CONCLUSION

This project represents a significant advancement in classroom monitoring and student engagement through the integration of drone technology and Arduino

microcontrollers. By automating attendance tracking and participation monitoring, the system offers a novel approach to enhancing teaching methodologies and fostering student interaction. Through the implementation of Arduino-based hardware and software solutions, the project demonstrates the feasibility and effectiveness of utilizing drones for real-time classroom monitoring . The system's ability to accurately detect student presence and provide insights into engagement levels during lectures has the potential to revolutionize traditional teaching practices and improve learning outcomes.

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