

Gym ERP Management System using Machine Learning

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Abstract- The COVID-19 pandemic has disrupted numerous industries, with gyms being particularly affected. Their operational setup, involving multiple touchpoints, poses an increased risk of virus transmission. Consequently, there is a pressing need to minimize human interaction within gyms, especially for tasks like attendance tracking and registration. To address this concern, a proposed solution involves implementing a contactless attendance monitoring system integrated with an Enterprise Resource Planning (ERP) platform. This system utilizes facial recognition technology to identify gym members upon entry without the need for physical contact. This innovative system incorporates facial recognition techniques utilizing Elman neural network algorithms. Image fragmentation using Curvelet transform methods and subsequent feature extraction via Principal Component Analysis (PCA) are integral parts of this technology. Moreover, the system is equipped with a specialized camera system designed specifically for accurate facial recognition purposes. Impressively, the proposed algorithm demonstrates a high accuracy rate of 94%, ensuring reliable identification of gym members without direct physical interaction. By leveraging these advanced technologies, gyms strive to not only enhance safety measures amid the pandemic but also optimize their operations. The implementation of a contactless attendance monitoring system, combined with facial recognition capabilities, not only reduces physical touchpoints but also streamlines gym procedures, ensuring a secure and efficient experience for members entering the facility.

Keywords- Face Recognition, Covid19, ERP, Attendance monitoring, Machine Learning.

I. INTRODUCTION

The COVID-19 pandemic significantly disrupted the fitness industry, with gyms experiencing substantial setbacks due to mandated closures and operational restrictions. As these facilities began to contemplate reopening, they encountered significant challenges, especially concerning the management of participant entry and safety protocols. Traditional methods of attendance tracking posed elevated health risks, requiring close human interaction and potentially compromising safety measures. During the reopening phase, gyms grappled with the daunting task of

ensuring the safety of patrons as they entered the premises. Conventional manual attendance systems posed inherent risks due to the necessity for staff and participants to interact closely. This heightened potential exposure to the virus, raising concerns about infection spread within the gym environment.

Moreover, the existing management practices for attendance monitoring became increasingly burdensome amid the pandemic's safety requirements. Implementation of Personal Protection Equipment (PPE), adherence to social distancing norms, and the added workload of manually tracking attendance placed significant strain on the gym's management staff. These challenges highlighted the urgency for a more streamlined and contactless system to enhance operational efficiency while prioritizing safety. To address these concerns and meet the gym's enterprise resource planning (ERP) needs effectively, a comprehensive, automated, and contactless attendance monitoring system is proposed. This advanced system seeks to equip gym owners with a centralized database that encompasses comprehensive member information. This includes attendance records, exercise routines, dietary plans, and other relevant data crucial for effective management and personalized member engagement.

By leveraging technological advancements, this proposed system aims to eliminate the need for close human interaction during attendance tracking. Utilizing cutting-edge technology such as facial recognition, integrated with an Enterprise Resource Planning (ERP) system, the solution intends to automate attendance monitoring, thereby minimizing health risks associated with manual check-ins. Furthermore, this system offers an array of benefits beyond attendance tracking. It streamlines gym operations, allowing for seamless management of member information. Gym owners gain access to a sophisticated tool that not only tracks attendance but also compiles and manages a comprehensive database of each member's fitness journey. Additionally, it facilitates automated periodic data reviews, which are conveniently disseminated to members through SMS or email notifications.

The implementation of an automated and contactless system in gym management is poised to revolutionize operational efficiency while prioritizing health and safety. This innovative solution aims to mitigate infection risks associated with manual attendance systems and reduce the strain on management staff caused by pandemic-related safety measures. By centralizing and automating essential



gym functions, this proposed system offers a more secure, efficient, and personalized experience for both staff and members alike.

II. PROPOSED SYSTEM

The proposed system encompasses comprehensive gym member management, an Enterprise Resource Planning (ERP) solution tailored for gyms, routine health monitoring for users, and attendance tracking utilizing facial recognition driven by machine learning. This system operates on the principles of simplicity, contact lessness, and automation. It leverages sophisticated facial detection methodologies to seamlessly register attendance without the need for manual input or identity verification. The system's hardware comprises a camera module strategically positioned at the gym's entrance. This module captures visitors' images and employs facial recognition techniques to compare them with stored pictures in the database.

The system functions through three distinct access levels and roles: user, administrator, and super administrator. Individuals within the system are identified as gym members. The administrator assumes the responsibility of initially registering members in the system's database, which includes storing their relevant data, including photographs. During routine visits, members briefly face the camera for identification purposes. The camera captures their image, which is then analyzed using facial recognition technology. The system compares the captured image with those previously stored in the database, allowing access to the gym, and simultaneously recording attendance upon verification.

The ERP system's administrative section empowers the gym's administrator to perform various managerial tasks. These tasks encompass issuing invoices, communicating messages to users, adding, or modifying client information, managing subscriptions, creating, or adjusting batches, and monitoring expenses. On the other hand, the gym's Super Admin possesses extended privileges, allowing actions such as adding new members, displaying member data, adding, or activating subscriptions, and modifying or updating member records. This integrated system streamlines gym operations by automating attendance monitoring and facilitating seamless access for members. The utilization of facial recognition technology ensures accurate and efficient attendance recording, eliminating the need for manual intervention. Moreover, the system's multi-tiered access levels grant appropriate permissions to administrators and super administrators, enabling them to efficiently manage various aspects of gym operations, from membership administration to financial oversight.

The automated features embedded within the ERP system offer convenience and efficiency to gym management. By centralizing data management and attendance monitoring, the system significantly reduces administrative burdens.

Additionally, the functionality to issue invoices, communicate with users, manage subscriptions, and monitor expenses via the administrative module enhances the overall operational efficiency of the gym. In essence, this proposed system not only revolutionizes attendance tracking through contactless facial recognition but also provides a comprehensive administrative tool for efficient gym management. Its simplicity, automation, and distinct access levels empower administrators to effectively oversee diverse aspects of gym operations, contributing to a more streamlined and user-friendly fitness environment.

III. METHODOLOGY

Creating an attendance tracking and ERP automation system involved several key processes:

A) Development of a browser-based web application: HTML, CSS, JavaScript, and Angular.js were utilized to construct a content management portal within a browser-based online application. This web application facilitates data storage, viewing, and transmission via REST API methods to interact with the web server.

B) Creation of a node.js web server application: The web server incorporates a face recognition program responsible for monitoring attendance. Queries sent from the web application are processed by the server-side program scripted in node.js, providing data back to the web-based application upon request completion.

C) Establishment of a back4app database: This database stores essential member data required by both the web and server applications, serving as the repository for all necessary information. Additionally, it hosts the recorded face data values utilized for facial recognition and attendance tracking.

D) Face recognition methodology: The system utilizes Region of Interest (ROI) techniques to extract specific parts of images, Principal Component Analysis (PCA) to select key features, and Support Vector Machines (SVM) for data categorization. To enhance the system's effectiveness, various photographs of subjects were captured under diverse conditions, angles, and lighting scenarios. By implementing these algorithms, the system efficiently records, analyzes, and marks attendance within the database.



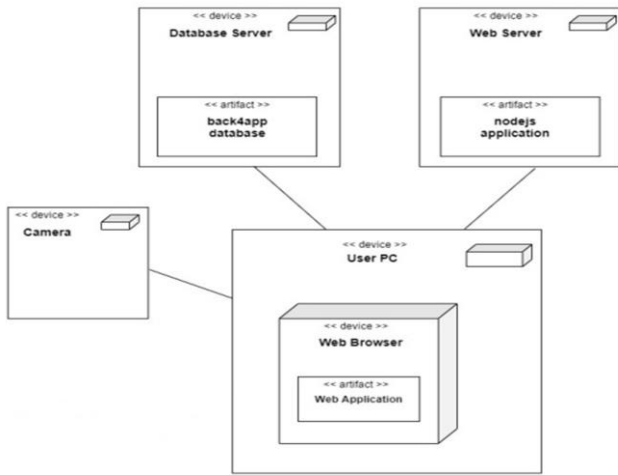


Fig. 1. Deployment Diagram



Fig. 2. Use Case Diagram

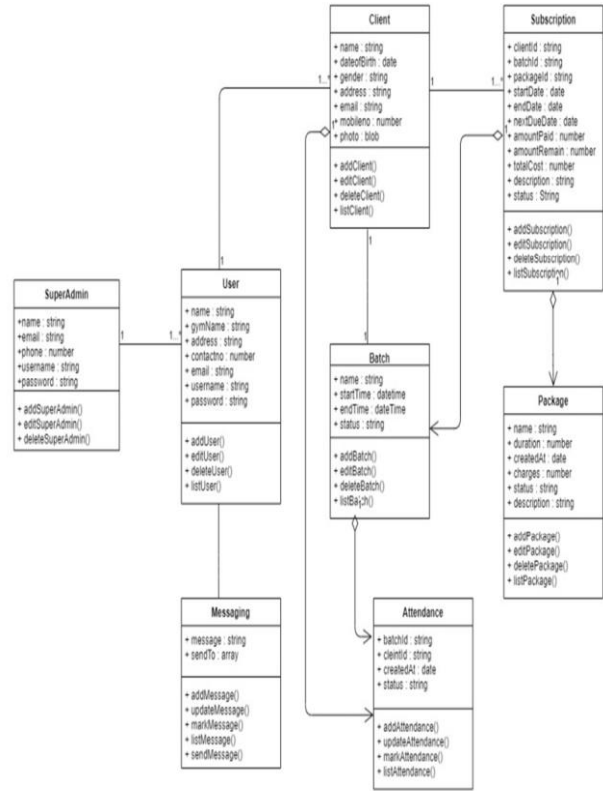


Fig. 3. Class Diagram

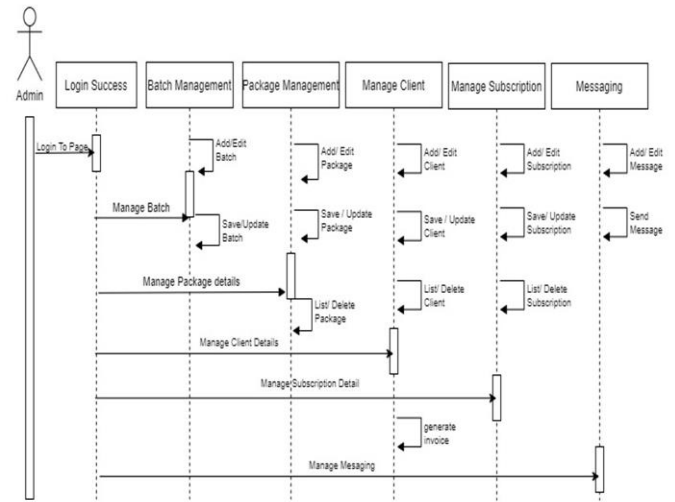


Fig. 4. Sequence Diagram

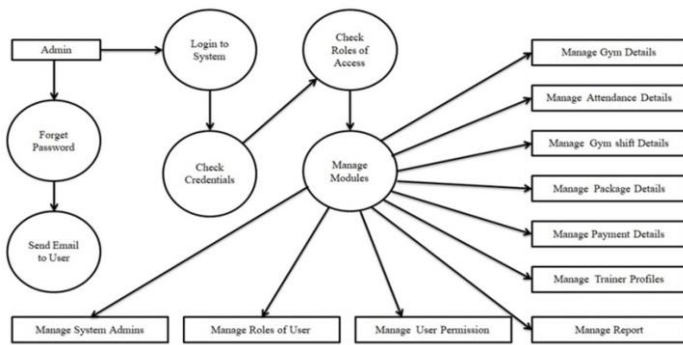


Fig. 5. Data Flow Diagram

IV. EXPECTED RESULTS

This proposed system offers several anticipated advantages:

Firstly, it streamlines gym operations by automating various management tasks, such as attendance monitoring and tracking members' health vitals. This automation allows for efficient and accurate handling of crucial gym-related data, enhancing overall operational efficiency.

Secondly, the system aims to reduce direct physical interaction between gym members and staff. By implementing contactless processes for attendance tracking and data management, the system helps minimize potential transmission risks, especially during times of health concerns like the COVID-19 pandemic. This reduction in face-to-face interactions contributes to a safer environment within the gym premises.

Additionally, the system's accessibility from remote locations is a key benefit. Members can conveniently access the system's data and functionalities without the need for physical presence at the gym. This remote access facilitates ease of interaction with the gym's resources, enabling members to view their attendance records, health metrics, or other pertinent information from anywhere, enhancing convenience and flexibility in managing their gym-related activities.

Overall, these anticipated advantages encompass operational efficiency, enhanced safety measures through reduced physical contact, and improved accessibility and convenience for members, promoting a more streamlined and user-friendly gym experience.

V. CONCLUSION

The fitness industry has faced substantial challenges due to recent infectious diseases, particularly the COVID-19 pandemic, with gyms being one of the most severely affected sectors. The impact extended beyond businesses,

affecting individuals who rely on gyms for their regular health and fitness routines. Gyms present multiple touchpoints, making their reopening and regular operations challenging amid heightened concerns about virus transmission. The proximity between gym-goers and staff poses significant risks for both parties. Addressing these challenges, a proposed touchless gym Enterprise Resource Planning (ERP) system coupled with a vital signs monitoring setup offers a potential solution. This integrated system aims to promote social distancing and reduce physical touchpoints within gym facilities.

Utilizing recent advancements in machine learning and face detection technologies, it facilitates attendance monitoring and identification without necessitating physical interaction. This advancement minimizes human contact, potentially serving as a pivotal strategy in reducing the risk of infection transmission within gym premises. The touchless gym ERP system's functionality not only includes attendance tracking but also streamlines administrative tasks critical for gym management. Moreover, it allows the system's administrators and super administrators to efficiently oversee and administer gym operations without direct physical interactions with users. Instead, they can provide essential data and communicate with gym members through messaging functionalities embedded within the ERP system.

The fitness industry has been drastically impacted by recent infectious diseases, particularly the onset of the COVID-19 pandemic, resulting in severe setbacks for gyms. This has not only adversely affected the financial viability of these establishments but also disrupted the regular fitness routines of numerous individuals reliant on these facilities for their health and well-being. With gyms serving as potential hotspots due to the multitude of contact points, their reopening and normal operations have presented considerable challenges. The proximity between gym attendees and staff has raised concerns regarding the risk of virus transmission, necessitating stringent measures to ensure the safety of patrons and employees within these spaces.

In response to these challenges, a groundbreaking touchless gym Enterprise Resource Planning (ERP) system, coupled with sophisticated vital signs monitoring, emerges as a promising solution. This innovative system aims to uphold social distancing measures and mitigate physical touchpoints prevalent within gym premises. Leveraging cutting-edge advancements in machine learning and facial recognition technologies, it enables seamless attendance tracking and user identification without the need for direct physical interaction. By significantly reducing instances of human contact, this system seeks to potentially lower the risk of infectious disease transmission within gym facilities, fostering a safer environment for all.

The touchless gym ERP system boasts comprehensive functionalities, encompassing efficient attendance



monitoring and streamlining the administrative tasks integral to managing a gym. Furthermore, it empowers administrators and super administrators to oversee gym operations remotely, minimizing direct contact with gym-goers while facilitating communication through embedded messaging features. Supplementing the touchless ERP system, the integration of a vitals monitoring system further elevates safety protocols within gym settings. Continuous monitoring of crucial health metrics, such as body temperature and heart rate, serves as an early warning system for potential health concerns among gym attendees. This proactive approach enables swift interventions, effectively mitigating health risks and contributing to the creation of a secure and health-conscious gym environment.

The amalgamation of innovative technologies and automated solutions within the touchless gym ERP system not only addresses the immediate challenges faced by gyms during health crises but also signifies a significant stride toward ensuring the safety and well-being of individuals frequenting fitness facilities in the face of infectious diseases. This comprehensive approach prioritizes health and safety, striving to redefine the operational landscape of gyms by minimizing potential health hazards and fostering a renewed sense of security for gym-goers and staff alike. The integration of a vitals monitoring system alongside the touchless ERP further enhances safety measures within gym environments. Regular monitoring of vital health metrics, such as temperature and heart rate, enables early detection of potential health concerns among gym attendees. This proactive approach allows for prompt interventions and minimizes health risks, contributing to a safer gym environment. By leveraging these innovative technologies and automation, the touchless gym ERP system revolutionizes gym operations in the context of health crises. The reduced reliance on physical interactions, coupled with improved administrative efficiency, aims to create a safer environment for gym-goers and staff alike. This multifaceted approach not only addresses the challenges faced by gyms but also represents a significant step toward ensuring the safety and well-being of individuals using fitness facilities during times of infectious diseases.

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