Centralized PHC Monitoring and Management System Using Machine Learning

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Abstract: **This system is designed to centralize the operations of Primary Health Centers (PHCs), Upgraded PHCs, and Subcenters, integrating them with the District Deputy Director of Health Services (DDHS) for real-time monitoring. By leveraging advanced technologies, the system offers a comprehensive solution for efficient healthcare management. One of its key features is the tracking of doctor attendance using face recognition technology, which ensures accurate marking of attendance and generates automated absenteeism alerts for better workforce management.**

The system also facilitates PHC monitoring by maintaining detailed patient information and generating daily update forms. These updates are automatically analyzed and presented in graphical formats, allowing for clear insights into service delivery and patient care.

Furthermore, the system enables seamless communication by sending daily or monthly reports to the DDHS, supporting effective decision-making and improving overall healthcare management. By centralizing and automating critical functions, this system enhances operational efficiency, accountability, and the quality of healthcare services.

Keywords— Face Recognition Attendance, Automated alert, PHC center Integration, Anomaly detection.

I. INTRODUCTION

An inventive and all-inclusive solution, the Centralized Primary Health Center (PHC) Monitoring and Management System was created to maximize the performance and administration of PHCs, Upgraded PHCs, and Subcenters. Its main goals are to improve healthcare delivery, expedite administrative duties, and guarantee improved resource tracking and management throughout the healthcare system.

The system's incorporation of facial recognition technology for tracking doctor attendance is one of its most notable aspects. By removing human error and guaranteeing the accuracy of attendance data, this state-of-the-art technology guarantees accurate attendance records. The system's automation of this procedure not only increases the precision of physician attendance but also initiates automated absenteeism notifications. When attendance irregularities are discovered, these warnings enable authorities to act quickly and intelligently, guaranteeing prompt intervention and lowering the dangers related to absenteeism.

By facilitating the upkeep of patient records and regular updates, the system goes above and beyond attendance tracking, guaranteeing that medical professionals have instant access to critical patient data. The quality of healthcare services is improved by this ongoing update process, which helps make decisions more effectively and intelligently.

Furthermore, the information gathered by the system is examined and displayed as graphical reports, providing insightful information about the general performance of medical facilities. These observations are essential for assessing performance and can help managers pinpoint areas that need work. More evidence-based decision-making is made possible by this analytical method, which enhances operational effectiveness and service delivery.

Additionally, the technology makes it easier for daily and monthly reports to be automatically generated and sent to the District Deputy Health Services (DDHS). By giving decision-makers current and accurate reports on PHC operations, this element not only improves administrative transparency but also encourages accountability.

To sum up, the Centralized PHC Monitoring and Management System is a comprehensive solution that equips healthcare administrators and providers with the technologies required to guarantee improved performance monitoring, healthcare management, and general transparency in the healthcare ecosystem.

Its incorporation of data-driven reports, real-time patient record updates, and facial recognition for attendance makes it a revolutionary tool for enhancing basic healthcare operations

II. RELATED WORK

A key element of contemporary healthcare administration, real-time healthcare monitoring has been the subject of numerous research and systems. In order to increase data accessibility and decision-making effectiveness, healthcare management systems have focused on integrating Primary Health Centers (PHCs) and Subcenters with centralized monitoring platforms. Rajput et al. (2018), for instance, presented a real-time health monitoring system that connects district health authorities and nearby healthcare facilities. This technology improved administrative control and patient care by providing instant access to patient data. Real-time monitoring and the integration of several healthcare facilities are essential for guaranteeing the effective delivery of healthcare services as well as the early detection and resolution of problems.

With automation as the main focus, attendance tracking in healthcare systems has attracted a lot of attention. Conventional manual attendance techniques are ineffective and prone to mistakes. Numerous studies have looked into the use of face recognition technologies for tracking attendance in medical settings. In order to improve accountability and reduce the problems associated with manual attendance, Sharma et al. (2019) talked about the usage of facial recognition technology in hospitals to track doctor attendance. Like the method you are suggesting, they employed the Haar cascade algorithm and the Local Binary Patterns Histogram (LBPH) face recognizer. Even in a congested setting, these technologies were able to precisely identify doctors, guaranteeing reliable attendance tracking.

Healthcare systems have also started using automated absenteeism warnings to make sure that doctors are on time and available when needed. In order to inform employees when attendance marking was overlooked or delayed, Patel et al. (2020) suggested a system that included automated SMS and email warnings. Medical personnel's punctuality has improved thanks to these platforms, which have also given administrators timely information to take corrective measures. This strategy is in line with your system's implementation of doctor absenteeism warnings, which guarantees that any problems with attendance are resolved quickly.

Additionally, prior studies have emphasized the need of tracking patient data and offering graphical analysis of patterns. Systems such as those created by Ghosh et al. (2017) combined automated reporting capabilities with patient record-keeping. These systems allowed healthcare authorities to effectively monitor the delivery of healthcare services by storing patient data, treatment specifics, and attendance records. Through real-time data analysis, these systems enabled well-informed decision-making. An extension of these concepts is the proposed system's ability to send daily or monthly reports to health authorities, which enables the District Deputy Director of Health Services (DDHS) to remain up to date on the medical operations at the PHCs.

Finally, a lot of study has been done on anomaly detection systems in relation to healthcare monitoring. Finding abrupt increases or decreases in the patient population aids in spotting possible medical emergencies or problems with the way services are being provided. Your system's anomaly detection feature, which sends out automated notifications to the DDHS, is consistent with research by Singh et al. (2018), who identified odd trends in patient visits at healthcare facilities using data analysis and machine learning approaches. Their system's ability to notify administrators automatically allowed for prompt reactions to unforeseen shifts in the patient load. This keeps medical facilities from becoming overburdened and guarantees that sufficient resources are accessible when needed.

In order to increase overall efficiency and service delivery, these connected works highlight the growing significance of incorporating real-time data, automated attendance tracking, patient management, and anomaly detection into healthcare systems. These ideas are expanded upon by your system, which incorporates them into a complete PHC-level healthcare management solution.

III.METHODOLOGIES

Module 1: Facial Recognition Attendance Monitoring

Description: To precisely track doctor attendance, the Doctor Attendance Tracking Module employs

OpenCV in Python and facial recognition. For real-time identification, it makes use of the LBPH face recognizer and the Haar cascade technique. In order to improve accountability and resource management in healthcare facilities, attendance data and timestamps are automatically forwarded to the District Deputy Director of Health Services (DDHS) in a CSV file for monitoring and record-keeping.

Module 2: Automated Absenteeism Alerts
Description: Doctors who fail to indicate their attendance within a specified time range receive automated email or SMS reminders from the system. This reminder increases accountability, guarantees accurate attendance records, and lowers absenteeism. Administrators can keep an eye on attendance problems and take swift action to keep healthcare operations running smoothly.

Module 3: Healthcare Service Monitoring
Description: The system ensures real-time recording of patient data at Primary Health Centers (PHCs), including treatments, diagnoses, and attendance. It stores this information in a database and generates daily or monthly reports, which are emailed to the Deputy Director of Health Services (DDHS) in CSV format. This automated reporting helps the DDHS monitor operations, plan resources, and intervene promptly when needed.

Module 4: PHC Center Integration & Analysis
Description: The system provides graphical analysis of patient patterns, diagnoses, and treatments over time by combining data from several Primary Health Centers (PHCs) onto a single platform. This makes it possible for officials to keep an eye on performance, spot medical trends, and decide how best to allocate resources and provide healthcare.

Module 5: Anomaly Detection
Description: The system tracks the number of patients at PHC facilities and identifies any unexpected variations. The Deputy Director of Health Services (DDHS) is automatically notified via email when an anomaly is discovered, allowing for prompt action to handle medical emergencies, reallocate resources, or look into the reason for the change.

IV.EXISTING SYSTEM

The existing system for managing healthcare operations in Primary Health Centers (PHCs) and rural healthcare facilities is primarily manual and fragmented, lacking integration with more advanced digital solutions. While larger hospitals benefit from automated systems that streamline patient and doctor records, appointment scheduling, and monitoring, PHCs still rely heavily on paper-based methods for tracking doctor attendance and patient care. Doctor attendance is often recorded manually in physical registers or attendance sheets, which are prone to errors, delays, and inefficiencies in data collection. This outdated approach makes it difficult to maintain accurate and timely records of staff presence, affecting overall accountability. Additionally, patient data management and healthcare service delivery are handled separately across different levels of healthcare centers, such as PHCs, Upgraded PHCs, and Subcenters, with limited coordination between these facilities and the Deputy Director of Health Services (DDHS). As a result, real-time monitoring and efficient decision-making are compromised, hindering the ability to respond effectively to health crises or allocate resources where they are most needed. This disjointed system leads to administrative inefficiencies and limits the quality of care provided in rural and remote areas.

V.PROPOSED SYSTEM

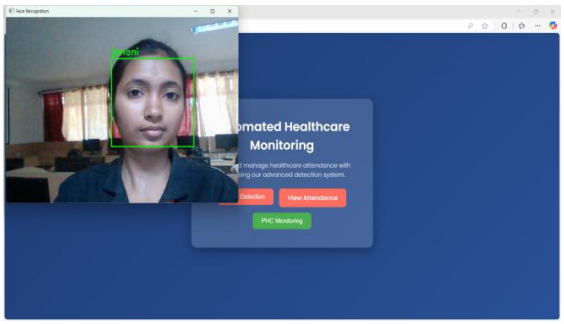
Through the integration of cutting-edge technology for effective monitoring and data management, the proposed system seeks to improve healthcare management at Primary Health Centers (PHCs). In order to precisely track doctor attendance, it uses OpenCV in Python for facial recognition, implementing the Haar cascade technique and the Local Binary Patterns Histogram (LBPH) face recognizer. The technology automatically notifies doctors via email or SMS if they don't register attendance within a predetermined window of time. Along with keeping attendance logs, the system also allows PHCs to update daily patient data, such as the number of patients treated, diagnosis, and treatments administered. The Deputy Director of Health Services (DDHS) automatically receives the daily or monthly reports it generates in CSV format for review. A centralized system that incorporates data from all PHC centers allows authorities to analyze the effectiveness of healthcare services across regions and provides graphical analysis of patient patterns. The system also has anomaly detection, which detects abrupt increases or decreases in the number of patients at PHC sites and automatically notifies the

DDHS, guaranteeing prompt actions and efficient healthcare administration.

VI.IMPLEMENTATION

The Centralized PHC Monitoring and Management System records patient data, tracks physician attendance, and creates automated reports by integrating data from several healthcare facilities. To guarantee effective management and prompt actions, it offers real-time analysis, identifies irregularities in patient trends, and issues alarms.

Feature 1



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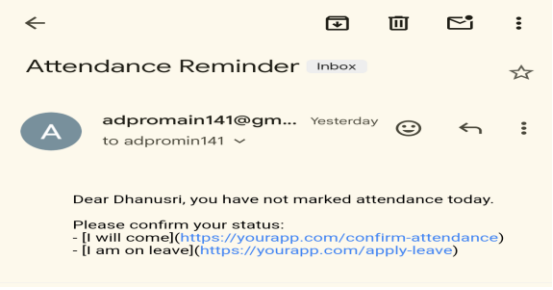

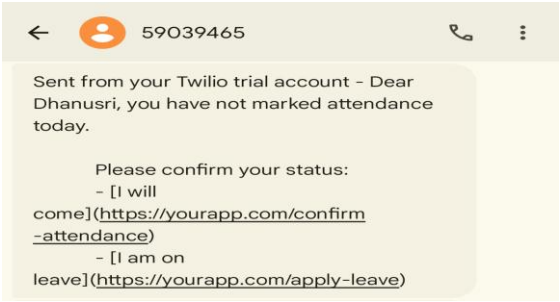

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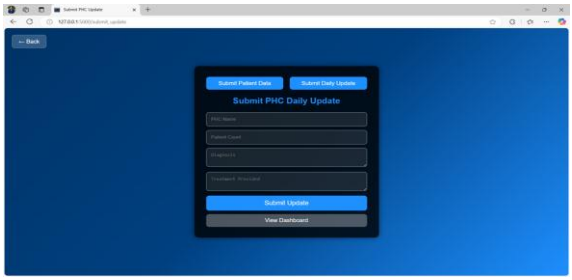

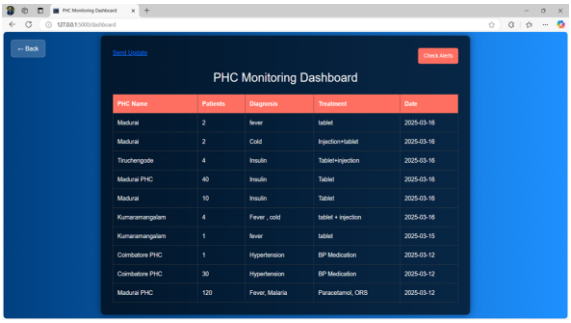

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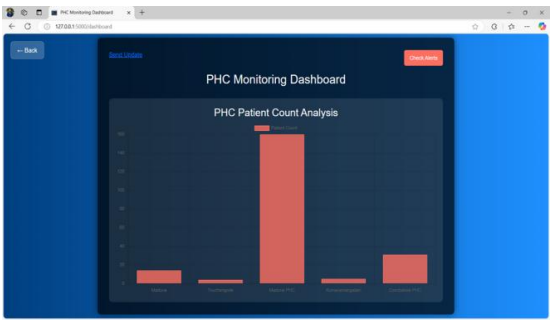

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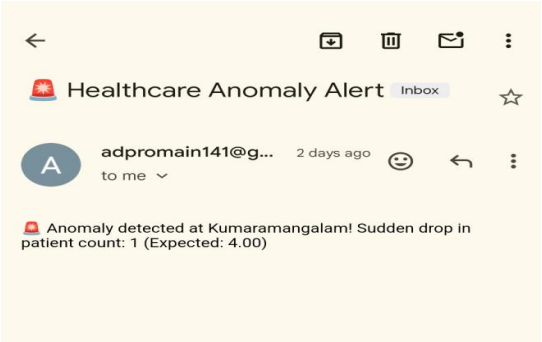

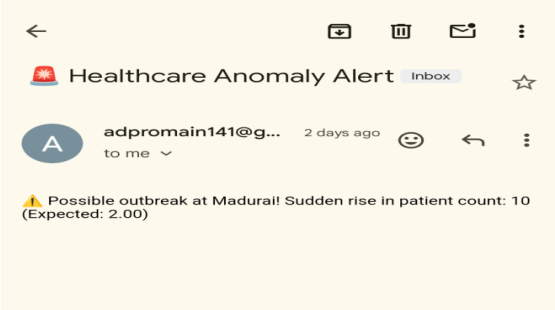

VII.CONCLUSION

The Centralized PHC Monitoring and Management System integrates cutting-edge technology for data management and real-time monitoring, greatly improving healthcare operations. While automated warnings help lower absenteeism and increase accountability, facial recognition technology guarantees accurate doctor attendance tracking. The centralized design of the system makes it easy for data to move between several PHCs, providing precise and prompt insights into patient patterns, diagnoses, and therapies.

Additionally, automatic report generation minimizes manual paperwork, guaranteeing timely delivery of current information to the Deputy Director of Health Services (DDHS). By seeing abrupt changes in patient numbers and alerting the DDHS for prompt action, the anomaly detection capability fortifies the system even further. In the end, this mix of automation, real-time data integration, and proactive warnings improves patient care and transparency throughout healthcare facilities by facilitating better decision-making, resource management, and healthcare delivery.

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