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SMART EMPLOYEE MONITORING SYSTEM USING MULTITASK DEEP LEARNING AND IOT

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ABSTRACT

Employee health, emotional well-being, and secure system usage are critical factors that directly influence productivity and organizational safety in modern workplaces. However, traditional monitoring approaches largely depend on manual supervision and fragmented data sources, making it difficult to accurately and promptly identify health risks, stress conditions, and unauthorized or risky system activities in real time. To overcome these limitations, this project proposes an IoT and AI based Employee State Monitoring System that integrates smartwatch health monitoring, facial analysis, facial expression assessment, and computer access log monitoring within a unified platform. The proposed system employs a fabricated smartwatch to continuously collect physiological parameters such as body temperature, heart rate, and blood pressure. In parallel, facial images captured through workplace cameras are analyzed using a multitask deep learning network to perform employee face recognition and facial expression analysis, enabling the identification of employee identity and emotional states such as stress and fatigue. Additionally, computer usage logs—including login activity, application usage, and website access history—are analyzed in real time to detect unusual behavior and access to unauthorized websites. All collected data streams are fused to assess the overall employee state dynamically. When abnormal health conditions, emotional stress, identity mismatches, or policy violations are detected, the system automatically generates alerts and notifies the Human Resources department through a centralized Employee State Monitoring Web Application. The proposed solution enhances workplace safety, employee well-being, and organizational security by enabling proactive monitoring, early risk detection, and timely HR intervention.

I. INTRODUCTION

1.1. OVERVIEW

Employee monitoring is the systematic observation and tracking of employees' activities during working hours, often using digital technologies, software applications, and artificial intelligence tools. Organizations use employee monitoring primarily to improve productivity, protect company resources, ensure compliance with organizational policies, and maintain workplace security. With the rapid growth of remote and hybrid work environments, employee monitoring has become increasingly common across industries. Employers may monitor activities such as internet usage, emails, application access, screen activity, keystrokes, and even employee locations through GPS tracking systems. These monitoring practices help organizations understand work patterns, identify inefficiencies, and prevent data theft or misuse of company assets. Various monitoring tools are widely used by companies depending on their requirements. Productivity and time-tracking software such as Time Doctor and Hub staff help managers measure employee performance and working hours. Advanced monitoring platforms like ActivTrak and Tera mind provide comprehensive tracking features, including application usage, screen recording, and behavioural analytics. For employees working in transportation or field operations, GPS-based systems such as Geotab and Samsara are used to monitor vehicle movement and employee locations in real time.

Although employee monitoring offers several benefits, it also raises important ethical and privacy concerns. Continuous surveillance can create feelings of mistrust among employees, reduce morale, and increase workplace stress if not implemented transparently. Therefore, organizations must establish clear monitoring policies, inform employees about what is being tracked, and ensure that monitoring practices comply with legal regulations and privacy laws. In many countries, including the United States under the Electronic Communications Privacy Act (ECPA) of 1986, employee monitoring is generally legal when conducted for

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legitimate business purposes. However, maintaining a balance between organizational security and employee privacy is essential for creating a healthy and trustworthy work environment.



Figure 1. Employee Monitoring

1.2. Artificial Intelligence (AI) and the Internet of Things (IoT)

The integration of Artificial Intelligence (AI) and the Internet of Things (IoT)—often referred to as AIoT—transforms passive, data-collecting devices into intelligent, autonomous systems. IoT provides the connectivity and raw sensory data, while AI supplies the cognitive ability to analyze that data and automate decisions without human intervention.

How AI and IoT Work Together

At its core, combining AI and IoT allows systems to process information, learn from patterns, and take action.

- **Data Collection (IoT):** Sensors and connected devices gather real-time data from their surroundings (e.g., temperature, motion, equipment vibrations).
- **Intelligent Analysis (AI):** Machine learning algorithms analyze this massive influx of data to find trends and anomalies.
- **Autonomous Action:** The AI tells the IoT devices how to respond—such as turning off a factory machine before it breaks or optimizing energy usage in a building.

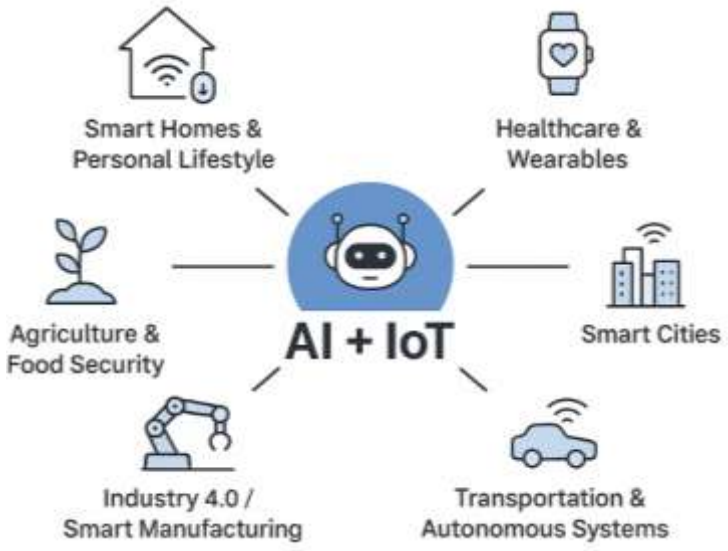


Figure 2. AI and IoT

Key Applications Across Industries

Integrating these two technologies drives innovation, efficiency, and cost-savings across several sectors:

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- **Smart Manufacturing (Industrial IoT):** AI analyzes performance data from assembly lines to predict equipment failures before they happen, drastically reducing costly downtime.
- **Smart Cities:** Traffic sensors collect real-time congestion data, and AI algorithms dynamically adjust traffic lights to optimize traffic flow.
- **Healthcare:** Wearable IoT devices monitor patient vitals, while AI systems evaluate these indicators to detect anomalies and alert doctors of potential health emergencies in real-time.
- **Smart Homes:** Smart thermostats and security systems learn daily habits over time to automatically adjust settings for maximum comfort and energy efficiency.
- **Smart Agriculture:** Soil sensors monitor humidity and link directly with automated irrigation systems, watering crops only when needed to maximize yield.

1.3. AIM AND OBJECTIVE

Aim

To develop a project for real-time monitoring of employee health, emotional state, and computer usage to improve workplace safety, productivity, and organizational security.

Objectives

- To monitor employee health parameters using IoT-based smartwatches.
- To perform real-time face recognition for employee identity verification.
- To analyze facial expressions for detecting stress and fatigue.
- To monitor computer usage and browser activities.
- To detect abnormal health conditions and risky behavior.
- To integrate health, facial, and log data into one system.
- To generate automated alerts for HR and administrators.
- To provide a centralized monitoring dashboard.
- To improve workplace safety and employee well-being.
- To enhance organizational security through intelligent monitorin

1.4. SCOPE OF THE PROJECT

The project focuses on developing an intelligent employee monitoring system that integrates IoT devices, facial analysis, and computer activity monitoring to improve workplace safety, employee well-being, and organizational security. The system continuously monitors employee health parameters such as heart rate, body temperature, and blood pressure using a smartwatch device, while workplace cameras capture facial images for identity verification and emotional state analysis using Multitask Deep Learning techniques. The system also monitors computer usage logs, including login activities, application usage, and website access history, to identify abnormal or unauthorized behavior. All collected data are combined to evaluate the overall employee condition in real time. Automated alerts are generated whenever abnormal health conditions, stress, fatigue, identity mismatches, or policy violations are detected, enabling HR personnel to take timely preventive or corrective actions. The proposed system can be applied in offices, corporate organizations, IT industries, and other professional workplaces that require continuous employee monitoring, improved productivity, enhanced security, and proactive risk management.

II. SYSTEM ANALYSIS

2.1. PROBLEMS DEFINITION

In modern workplaces, employee health, emotional well-being, and secure system usage play a vital role in maintaining productivity, efficiency, and organizational safety. However, most existing employee monitoring methods rely on manual supervision, attendance tracking systems, or isolated software tools that are unable to

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provide comprehensive real-time monitoring of employee conditions and activities. These traditional approaches often fail to identify health risks, emotional stress, fatigue, and unauthorized system usage at an early stage, which can negatively affect employee performance, workplace safety, and data security. Many organizations use separate systems for attendance monitoring, health tracking, and computer usage analysis, resulting in fragmented data management and lack of centralized monitoring. Existing systems are limited in their ability to combine physiological data, facial analysis, and behavioral monitoring into a single intelligent platform. As a result, abnormal health conditions such as high heart rate, stress, or fatigue may remain unnoticed for long periods, increasing the risk of reduced productivity, employee burnout, and workplace accidents. Similarly, unauthorized system access, risky computer activities, and policy violations may not be detected immediately, creating potential security threats for the organization. Another major challenge is the absence of intelligent real-time decision-making systems that can automatically analyze multiple data sources simultaneously and generate timely alerts for Human Resources departments. Manual observation and periodic supervision are time-consuming, inconsistent, and prone to human error. Organizations also face difficulties in identifying employee stress patterns, emotional discomfort, and unusual behavior trends using conventional monitoring methods. Therefore, there is a need for an integrated and intelligent employee monitoring solution that combines IoT-based health sensing, AI-driven facial recognition and facial expression analysis, and computer log monitoring into a unified system. Such a system should continuously monitor employee conditions, detect abnormal patterns in real time, generate automated alerts, and assist HR personnel in taking proactive preventive or corrective actions. The proposed system aims to address these challenges by providing continuous, secure, and intelligent monitoring to improve employee well-being, workplace productivity, and organizational security.

2.2. EXISTING SYSTEM

1. Manual Supervision

Traditional workplaces rely on managers or HR personnel to monitor employee health, attendance, and productivity. This approach is time-consuming, inconsistent, and prone to human error. Since monitoring depends heavily on manual observation, it becomes difficult to continuously track employee conditions in real time. Important signs of stress, fatigue, health risks, or unusual behavior may remain unnoticed, reducing workplace efficiency and safety.

2. Biometric Attendance Systems

Systems like fingerprint, RFID, or face recognition-based attendance track only employee presence. They do not monitor health, emotional well-being, or system usage, limiting proactive risk detection. These systems mainly focus on attendance management and cannot identify employee stress, abnormal health conditions, or risky computer activities. As a result, organizations lack deeper insights into employee well-being and workplace behavior.

3. Standalone Health Monitoring

Some organizations use wearable devices to track health metrics like heart rate or temperature. However, these devices operate in isolation and do not integrate with workplace systems, facial recognition, or behavioral monitoring. They only provide basic physiological readings without analyzing employee emotional state, computer activity, or workplace security risks. This limits the ability to perform intelligent and centralized monitoring.

4. Computer Activity Monitoring Software

Software tools track user activity, application usage, and browsing history. While useful for policy enforcement, they cannot detect employee stress, fatigue, or emotional well-being. These systems focus mainly on productivity and security monitoring without considering employee health conditions. They also lack integration with AI-based facial analysis and IoT health monitoring, making it difficult to assess the overall employee state accurately.

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2.2.1. DISADVANATGES

- Manual monitoring is time-consuming.
- Human supervision is prone to errors.
- Existing systems lack real-time monitoring.
- Attendance systems track only employee presence.
- Health monitoring devices work independently.
- Emotional stress and fatigue are not detected.
- Computer activity tools lack health analysis.
- Fragmented systems reduce monitoring efficiency.
- Delayed detection of abnormal conditions.
- Unauthorized system activities may go unnoticed.
- Lack of centralized monitoring and alert system.

2.3. PROPOSED SYSTEM

The proposed system integrates IoT-based health monitoring, AI-enabled facial recognition, facial expression analysis, and computer usage analysis into a unified intelligent platform. The system continuously monitors employee health conditions, emotional states, and workplace activities in real time to improve workplace safety, employee well-being, productivity, and organizational security. By combining smartwatch sensor data, AI-based facial analysis, and computer access monitoring, the system dynamically evaluates the overall employee condition and generates automated alerts for HR whenever abnormal situations or policy violations are detected.

1. IoT-Based Health Monitoring

A fabricated smartwatch continuously collects physiological parameters such as heart rate, body temperature, and blood pressure. The collected health data are transmitted to a central server in real time using HTTP/MQTT communication protocols. Threshold-based monitoring and anomaly detection algorithms analyze the readings to identify abnormal health conditions or stress-related symptoms. This enables early detection of potential health risks and supports proactive intervention to improve employee safety and well-being.

2. System Usage Monitoring

Workplace cameras capture employee facial images, which are processed using a Multitask Deep Learning (MTDL) network for employee identity verification and facial expression analysis. The system can detect emotional states such as stress, fatigue, discomfort, and neutral behavior. At the same time, computer logs including login activity, application usage, and website browsing history are monitored using rule-based algorithms to identify unusual or unauthorized activities. All collected information is combined to evaluate the employee's overall state in real time, and automated alerts are sent to the HR department through a centralized web dashboard for timely preventive or corrective action.

2.3.1. ADVANATGES

- Improves employee health and workplace safety.
- Enables early detection of stress and fatigue.
- Reduces risks caused by abnormal health conditions.
- Enhances organizational security and system safety.
- Supports real-time monitoring and quick response.
- Reduces manual supervision and human errors.

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- Improves employee productivity and work efficiency.
- Helps HR take timely preventive actions.
- Provides centralized monitoring and reporting facility.
- Detects unauthorized or risky computer activities.
- Enhances overall workplace management and decision-making.

III. REQUIREMENTS SPECIFICATION

3.1. HARDWARE SPECIFICATION

S.No	Hardware Component	Specification
1	Smartwatch (IoT Device)	Heart Rate, Temperature, BP Sensors
2	Employee Computer System	Intel i3+, 8GB RAM, 256GB SSD
3	Web Camera	720p HD Camera, 30 FPS
4	Central Server / Cloud	Multi-Core Processor, 16GB RAM
5	Network Connection	Stable Internet / Wi-Fi

3.2. SOFTWARE SPECIFICATIONS

S.No	Software Component	Specification
1	Operating System	Windows 10 / 11
2	Programming Language	Python, PHP
3	GUI Framework	Tkinter
4	Database	MySQL
5	AI Libraries	OpenCV, TensorFlow/PyTorch
6	Web Technologies	HTML, CSS, JavaScript
7	Web Server	Apache
8	Communication Protocol	HTTP / MQTT

IV. SYSTEM DESIGN

4.1. SYSTEM ARCHITECTURE

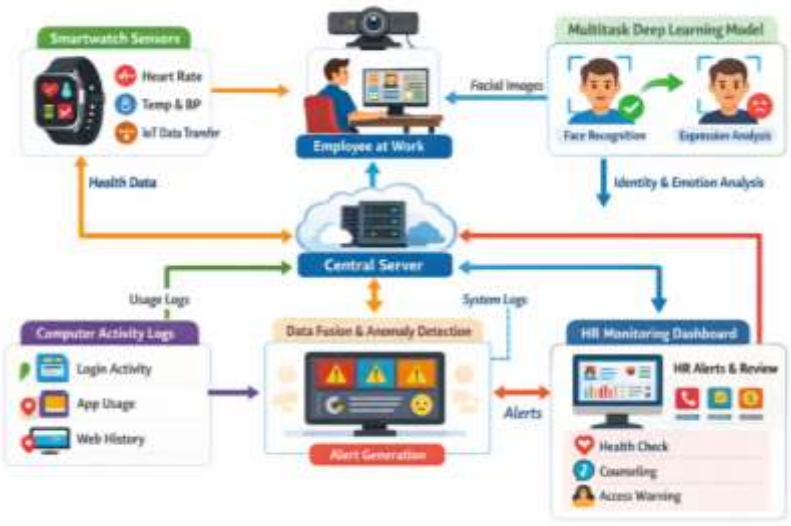


Figure 3. System Architecture

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4.2. DATA FLOW DIAGRAM

4.2.1. LEVEL 0

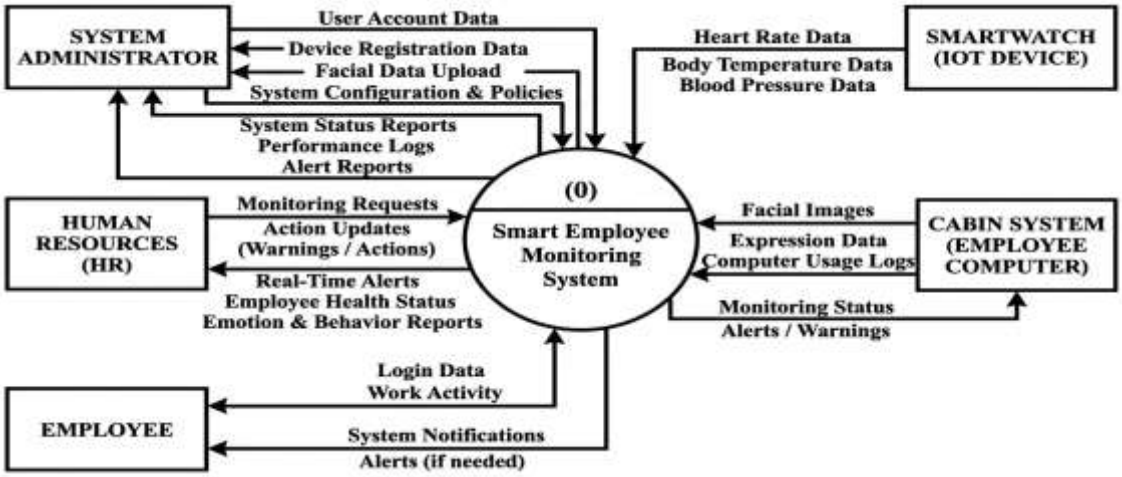


Figure 4. DFD Level 0

4.2.2. LEVEL 1

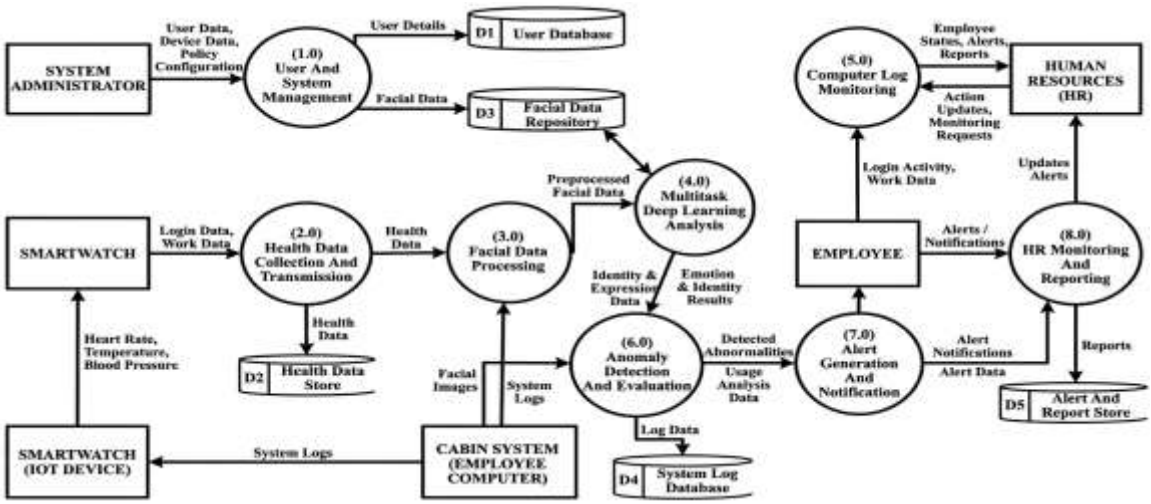


Figure 5. DFD Level 1

4.2.3. LEVEL 3

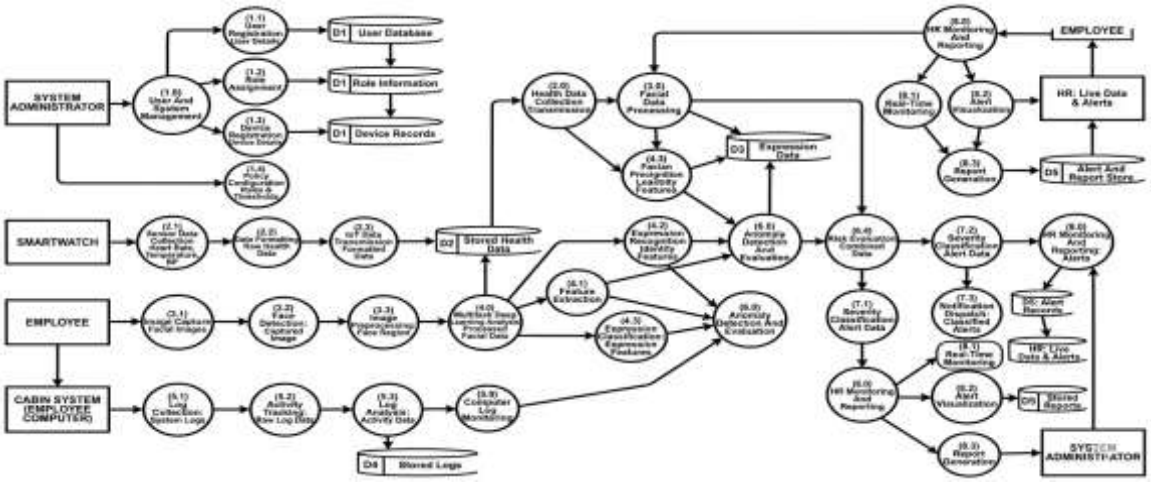


Figure 6. DFD Level 2

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4.3. USE CASE DIAGRAM

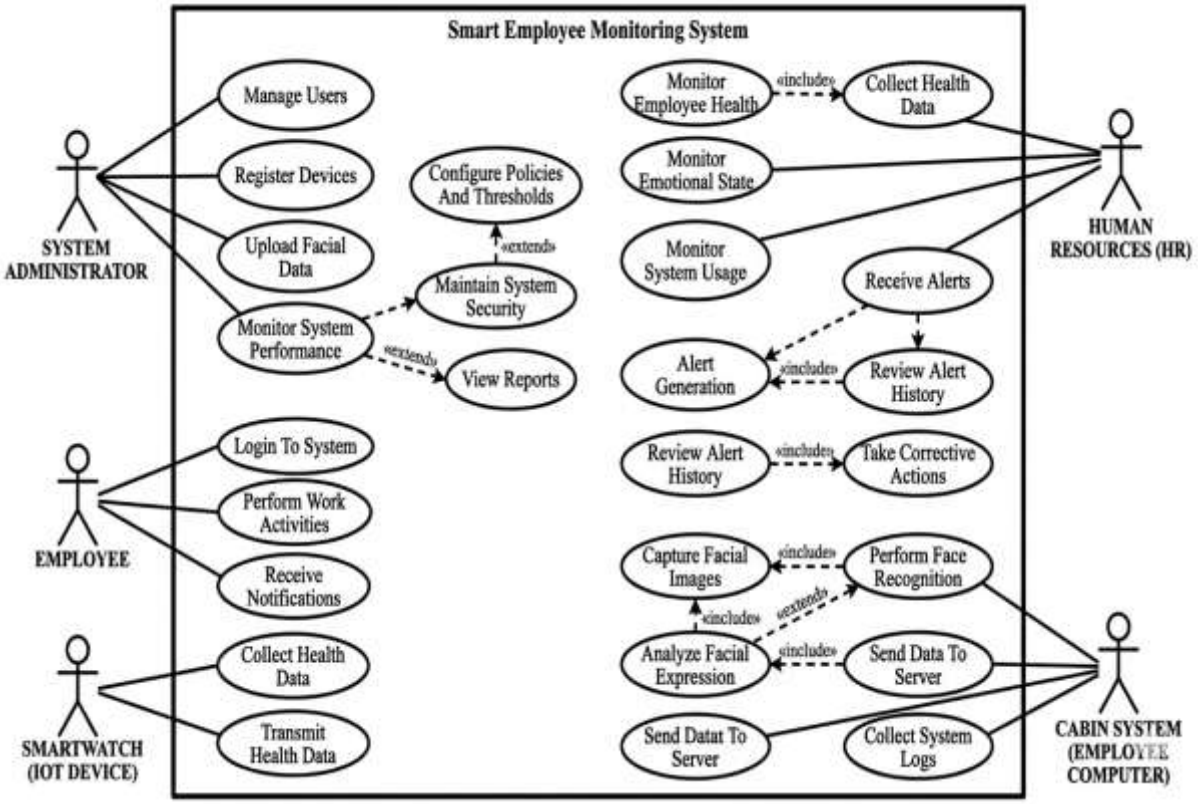


Figure 7. Use Case Diagram

4.4. CLASS DIAGRAM

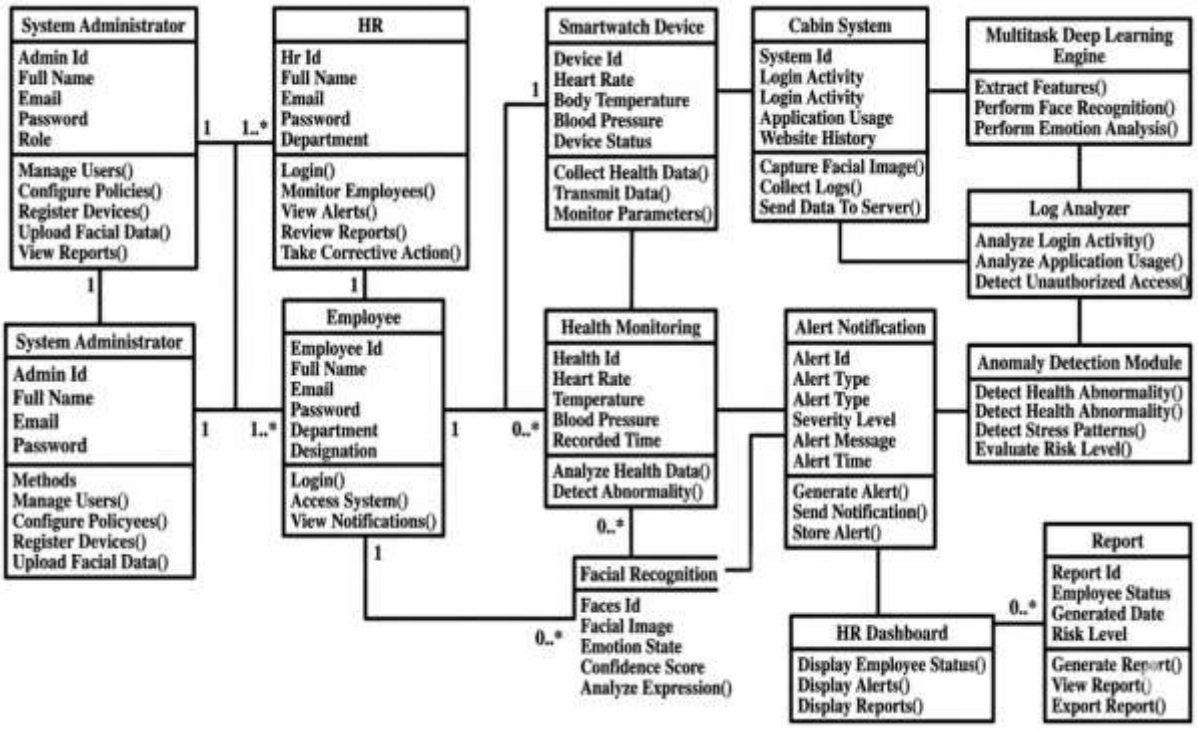


Figure 8. Class Diagram

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4.5. COLLABORATIVE DIAGRAM

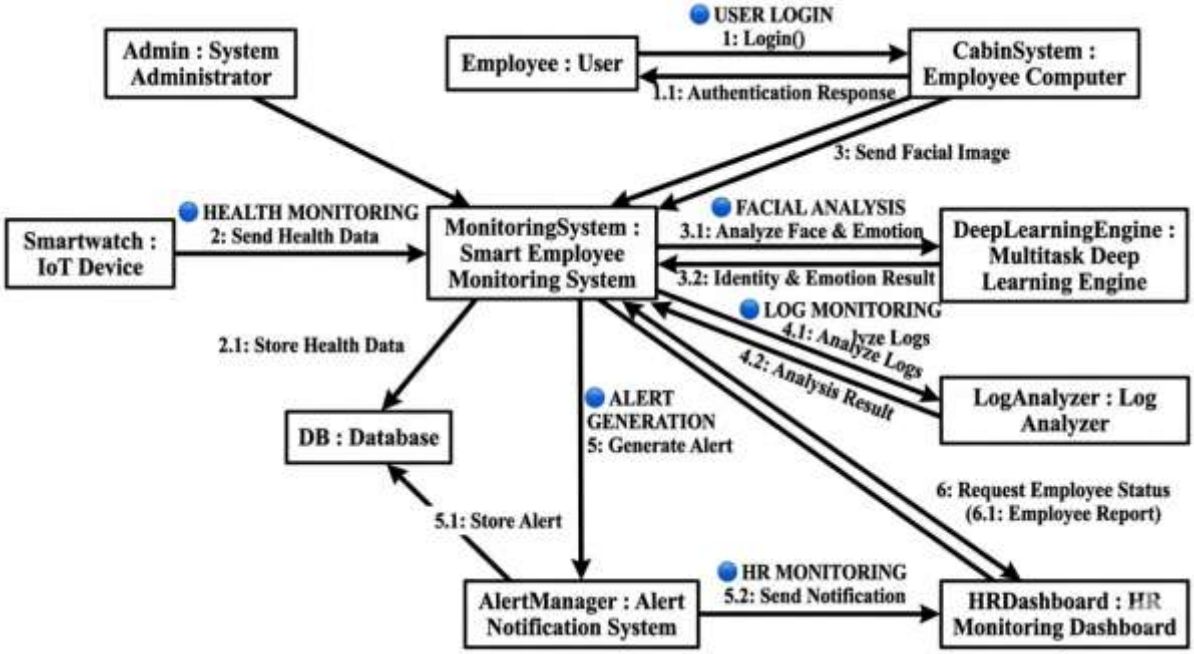


Figure 9. Collaborative Diagram

4.6. DATABASE DESIGN

1. System Administrator Table

Field Name	Data Type (Size, Constraints)	Description
Admin_Id	INT (Primary Key, Not Null)	Unique admin ID
Admin_Name	VARCHAR(100, Not Null)	Administrator name
Email	VARCHAR(100, Unique, Not Null)	Admin email
Password	VARCHAR(100, Not Null)	Login password
Phone_Number	VARCHAR(15, Not Null)	Contact number
Role	VARCHAR(50, Not Null)	Admin role

2. HR Table

Field Name	Data Type (Size, Constraints)	Description
Hr_Id	INT (Primary Key, Not Null)	Unique HR ID
Hr_Name	VARCHAR(100, Not Null)	HR employee name
Email	VARCHAR(100, Unique, Not Null)	HR email
Password	VARCHAR(100, Not Null)	Login password
Department	VARCHAR(100, Not Null)	Department name
Phone_Number	VARCHAR(15, Not Null)	Contact number

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3. Employee Table

Field Name	Data Type (Size, Constraints)	Description
Employee_Id	INT (Primary Key, Not Null)	Unique employee ID
Employee_Name	VARCHAR(100, Not Null)	Employee name
Email	VARCHAR(100, Unique, Not Null)	Employee email
Password	VARCHAR(100, Not Null)	Login password
Department	VARCHAR(100, Not Null)	Employee department
Designation	VARCHAR(100, Not Null)	Job role
Phone_Number	VARCHAR(15, Not Null)	Contact number

4. Smartwatch Health Data Table

Field Name	Data Type (Size, Constraints)	Description
Health_Id	INT (Primary Key, Not Null)	Unique health record ID
Employee_Id	INT (Foreign Key, Not Null)	Employee reference
Heart_Rate	INT (Not Null)	Heart rate value
Body_Temperature	FLOAT (Not Null)	Temperature reading
Blood_Pressure	VARCHAR(20, Not Null)	BP reading
Recorded_Time	DATETIME (Not Null)	Data recorded time

5. Facial Recognition Table

Field Name	Data Type (Size, Constraints)	Description
Face_Id	INT (Primary Key, Not Null)	Unique facial record ID
Employee_Id	INT (Foreign Key, Not Null)	Employee reference
Facial_Image	VARCHAR(255, Not Null)	Stored image path
Emotion_State	VARCHAR(50, Not Null)	Detected emotion
Confidence_Score	FLOAT (Not Null)	Prediction confidence
Captured_Time	DATETIME (Not Null)	Capture timestamp

6. Computer Log Table

Field Name	Data Type (Size, Constraints)	Description
Log_Id	INT (Primary Key, Not Null)	Unique log ID
Employee_Id	INT (Foreign Key, Not Null)	Employee reference
Login_Time	DATETIME (Not Null)	System login time
Application_Used	VARCHAR(100, Not Null)	Used application

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Website_Accessed	VARCHAR(255, Not Null)	Accessed website
Activity_Status	VARCHAR(50, Not Null)	Activity condition

7. Alert Notification Table

Field Name	Data Type (Size, Constraints)	Description
Alert_Id	INT (Primary Key, Not Null)	Unique alert ID
Employee_Id	INT (Foreign Key, Not Null)	Employee reference
Alert_Type	VARCHAR(100, Not Null)	Type of abnormality
Severity_Level	VARCHAR(50, Not Null)	Alert severity
Alert_Message	VARCHAR(255, Not Null)	Alert description
Alert_Time	DATETIME (Not Null)	Alert generated time

8. Device Registration Table

Field Name	Data Type (Size, Constraints)	Description
Device_Id	INT (Primary Key, Not Null)	Unique device ID
Employee_Id	INT (Foreign Key, Not Null)	Employee reference
Device_Type	VARCHAR(100, Not Null)	Device category
Device_Status	VARCHAR(50, Not Null)	Device condition
Connectivity_Type	VARCHAR(50, Not Null)	Wi-Fi/Bluetooth
Registered_Date	DATE (Not Null)	Registration date

V. SYSTEM TESTING

5.1. SOFTWARE TESTING

Software testing is an important process used to verify the functionality, reliability, security, and performance of the Smart Employee Monitoring System. It ensures that all modules such as IoT health monitoring, facial recognition, emotion analysis, computer log monitoring, and alert generation work correctly and efficiently. Testing helps identify errors, improve system stability, and ensure accurate real-time monitoring. Different testing techniques are performed to validate data processing, user interaction, security, and system integration. Proper software testing improves the overall quality, usability, and reliability of the proposed system.

5.1.1. Type of Testing

1. Unit Testing

Unit testing is performed to verify the individual modules of the system independently. Each component such as health data collection, facial recognition, and log monitoring is tested separately to ensure correct functionality. This testing helps detect coding errors at an early stage. It improves module reliability and simplifies debugging. Unit testing ensures that every function produces accurate output before integration with other modules.

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Test Cases

TCID	Input	Expected Result	Actual Result	Status
UT01	Employee Login Data	Successful Login	Successful Login	Pass
UT02	Heart Rate Value	Health Data Stored	Health Data Stored	Pass
UT03	Facial Image Input	Face Detected	Face Detected	Pass

2. Integration Testing

Integration testing verifies the interaction between multiple modules within the system. It ensures that smartwatch monitoring, facial analysis, computer log monitoring, and alert generation work together correctly. This testing validates data communication between IoT devices, AI modules, databases, and the HR dashboard. It helps identify interface and communication issues between connected components. Proper integration testing ensures smooth system operation.

Test Cases

TCID	Input	Expected Result	Actual Result	Status
IT01	Smartwatch Data Transmission	Data Sent To Server	Data Sent Successfully	Pass
IT02	Facial Image + AI Analysis	Emotion Detected	Emotion Detected	Pass
IT03	Alert Generation Request	HR Alert Generated	Alert Generated	Pass

3. System Testing

System testing evaluates the complete integrated system to ensure that all functionalities work according to project requirements. It validates overall system behavior including health monitoring, face recognition, log analysis, and notification services. This testing checks real-time performance, reliability, and end-to-end workflow execution. It also ensures that the system responds correctly under normal operating conditions. System testing confirms that the entire application functions as expected.

Test Cases

TCID	Input	Expected Result	Actual Result	Status
ST01	Employee Health Data	Abnormality Detection	Detected Successfully	Pass
ST02	Unauthorized Website Access	Alert Generation	Alert Generated	Pass
ST03	HR Dashboard Request	Display Employee Status	Status Displayed	Pass

4. Security Testing

Security testing is performed to ensure the protection of employee data, login credentials, and system resources from unauthorized access. It verifies authentication mechanisms, secure data transmission, and access control features. This testing checks whether sensitive information is protected against misuse or attacks. Security testing also ensures that only authorized users can access monitoring reports and system settings. It improves overall system confidentiality and reliability.

Test Cases

TCID	Input	Expected Result	Actual Result	Status
SCT01	Invalid Login Credentials	Access Denied	Access Denied	Pass

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SCT02	Unauthorized Dashboard Access	Permission Restricted	Restricted Successfully	Pass
SCT03	Secure Data Transmission	Encrypted Communication	Encryption Successful	Pass

5. Performance Testing

Performance testing evaluates the speed, responsiveness, and stability of the system under different workloads. It checks whether the system can process health data, facial images, and computer logs in real time without delays. This testing measures response time, alert generation speed, and server performance. It ensures that the system performs efficiently even when multiple users are monitored simultaneously. Performance testing helps maintain smooth and reliable operation.

Test Cases

TCID	Input	Expected Result	Actual Result	Status
PT01	Multiple Employee Data	Real-Time Processing	Processed Successfully	Pass
PT02	Continuous Facial Analysis	Fast Response	Response Within Limit	Pass
PT03	Simultaneous Alerts	Alerts Generated Quickly	Alerts Generated	Pass

5.3. TEST REPORT

Introduction

The testing process was conducted to verify the functionality, reliability, security, and performance of the Smart Employee Monitoring System. All major modules including health monitoring, facial recognition, computer log analysis, and alert generation were tested to ensure proper operation.

Test Objective

The objective of testing is to ensure that the system performs accurately, securely, and efficiently under different operating conditions.

Test Scope

The testing covers employee login, smartwatch health monitoring, facial recognition, emotion analysis, computer log monitoring, alert generation, and HR dashboard functionality.

Test Environment

Component	Specification
Operating System	Windows 10
Programming Language	Python, PHP
Database	MySQL
AI Libraries	OpenCV, TensorFlow
Web Server	Apache
Hardware	Intel i3, 8GB RAM

Test Result

The system successfully passed major functional, integration, security, and performance tests. All modules operated correctly and generated expected outputs with minimal issues.

Bug Report

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Minor bugs were identified during testing related to delayed alerts, incorrect facial recognition under low lighting, and temporary server response delay. These issues were corrected and verified successfully.

BID	TCID	Bug Description	Bug Status	Output
BUG01	IT03	Delay in HR alert notification	Fixed	Alert Generated Successfully
BUG02	UT03	Face detection failed in low light	Fixed	Face Detected Correctly
BUG03	PT02	Slow response during multiple requests	Fixed	Improved Response Time

Test Conclusion

The testing process confirmed that the Smart Employee Monitoring System functions effectively and meets the project requirements. The system provides accurate monitoring, secure data handling, real-time alert generation, and reliable overall performance.

VI. SYSTEM IMPLEMENTATION

6.1. MODULES DESCRIPTION

1. Employee State Monitoring Dashboard

The Employee State Monitoring Dashboard is the centralized web-based interface developed using PHP, MySQL, HTML/CSS/JavaScript, and Bootstrap technologies. It provides secure login access for HR personnel and system administrators to monitor employee health conditions, emotional states, and computer usage activities in real time. The dashboard displays live health readings, facial expression analysis results, login activities, application usage details, and alerts generated by the monitoring system. The dashboard also enables HR personnel to review historical records, generate reports, monitor employee performance trends, and take preventive or corrective actions whenever abnormal conditions are detected. Real-time notifications are displayed for stress, fatigue, unauthorized access attempts, abnormal health conditions, or policy violations. All monitoring activities, alerts, and administrative actions are securely stored and logged for audit, transparency, and security management purposes.

2. System User Dashboard

2.1. System Administrator

- Creating, updating, and managing employee and HR user accounts
- Registering and maintaining smartwatches and cabin systems
- Uploading and maintaining employee facial data for identity verification
- Defining rules, thresholds, and policies for health, emotion, and system usage alerts
- Monitoring system performance, data flow, and AI model updates
- Ensuring data security, access control, and proper configuration
- Performing backups, maintenance, and troubleshooting

2.2. Human Resources (HR)

- Receiving real-time alerts for abnormal health conditions, stress, fatigue, or policy violations
- Reviewing employee activity logs and historical reports
- Taking preventive or corrective actions such as counseling, health checks, or system warnings
- Supporting employee well-being and organizational safety through informed decisions

2.3. Employee

- Wear a smartwatch IoT device that continuously measures heart rate, body temperature, and blood pressure

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- Work on a cabin system (computer) that captures facial images, monitors emotional state via a multitask deep learning engine, and logs computer activity
- Benefit indirectly from real-time monitoring and timely interventions for health, stress, or policy compliance

3. Smartwatch Health Monitoring

The smartwatch health monitoring module continuously collects employee physiological parameters and sends them to the server in real time through IoT communication protocols. The collected health data are analyzed to identify abnormal conditions, stress symptoms, or health risks. Continuous health monitoring helps organizations improve employee well-being and enables early medical intervention when required.

3.1. Heart Rate Monitoring

The heart rate monitoring module measures the employee's heart rate at regular intervals using embedded sensors in the smartwatch. It helps identify abnormal patterns such as high heart rate, stress-induced spikes, or irregular heartbeat conditions. Continuous monitoring supports early detection of health risks and improves employee safety.

3.2. Body Temperature Monitoring

This module continuously measures employee body temperature to detect fever or abnormal temperature variations. Sudden increases in temperature may indicate illness, fatigue, or workplace stress conditions. Real-time monitoring enables quick preventive action and supports employee health management.

3.3. Blood Pressure Monitoring

The blood pressure monitoring module tracks systolic and diastolic blood pressure values continuously. It helps identify hypertension, unusual fluctuations, or stress-related pressure changes that may affect employee health and productivity.

4. Cabin System

4.1. Facial Image Capture

The cabin system uses a connected webcam to periodically capture live facial images of employees while they work. The captured images are forwarded to the AI processing module for face recognition and emotional state analysis. Continuous image capture supports secure monitoring and identity verification.

4.2. Multitask Deep Learning Engine

The Multitask Deep Learning Engine processes facial images using a shared feature extraction model. It simultaneously performs employee face recognition and facial expression analysis to identify emotional states such as stress, fatigue, discomfort, or neutral behavior. The unified deep learning approach improves efficiency and real-time performance.

4.3. Computer & Browser Log Collection

This module continuously monitors employee computer activities such as login/logout times, application usage, and website browsing history. The collected logs are analyzed to identify unauthorized access attempts, risky activities, or policy violations that may affect organizational security.

5. AI & Data Processing Module

5.1. Face Recognition Task

This module verifies employee identity by comparing captured facial images with registered employee facial data stored in the database. It helps prevent unauthorized access and ensures secure workplace system usage.

5.2. Facial Expression / Emotion Analysis

The emotion analysis module identifies emotional states such as stress, fatigue, discomfort, and neutral expressions from facial images. Continuous emotional analysis helps organizations monitor employee mental well-being and stress levels in real time.

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5.3. Anomaly Detection for Health & Activity

This module analyzes health readings and computer activities to identify abnormal patterns, unusual behaviors, or risky activities. It detects sudden health changes, continuous stress patterns, and unauthorized system usage automatically.

5.4. Multimodal Data Fusion

The multimodal fusion module combines smartwatch health data, facial recognition results, emotion analysis outputs, and computer activity logs into a single decision-making framework. This integrated analysis provides a more accurate evaluation of overall employee condition and workplace behavior.

6. Alert Generation

6.1. Abnormal Health Alerts

The system automatically generates alerts whenever employee health readings exceed predefined threshold values. These alerts help HR personnel take timely medical or preventive actions.

6.2. Stress / Fatigue Alerts

This module continuously analyzes facial expressions and identifies long-term stress or fatigue patterns. HR personnel receive alerts whenever continuous emotional stress conditions are detected.

6.3. Unauthorized Access / Policy Violation Alerts

The system monitors login behavior, application usage, and website access history to identify unauthorized activities or policy violations. Alerts are generated immediately to improve organizational security and prevent misuse.

7. HR Monitoring

7.1. Real-Time Employee Monitoring

The HR dashboard displays live employee health metrics, emotional states, computer usage activities, and system alerts. Real-time visualization helps HR personnel monitor workplace conditions efficiently.

7.2. Review Alert History

This module allows HR personnel to review previous alerts, analyze employee behavior trends, and identify recurring stress or policy violation patterns. Historical analysis supports better decision-making and workplace management.

7.3. Preventive or Corrective Action

Based on system alerts and reports, HR personnel can initiate preventive or corrective measures such as counseling sessions, health checkups, workload adjustments, or security warnings to improve employee well-being and workplace safety.

6.2. ALGORITHM USED

The proposed system uses a Multitask Deep Learning (MTDL) algorithm to perform employee face recognition and facial expression analysis simultaneously. The algorithm processes facial images captured from workplace cameras and extracts shared facial features using a common deep learning backbone. It identifies employee identity and detects emotional states such as stress, fatigue, discomfort, or neutral behavior in real time. The system also combines health monitoring and computer activity analysis to improve overall employee state evaluation. The algorithm enables faster processing, reduced computational cost, and improved monitoring accuracy.

Algorithm Workflow

Step 1: Capture facial image using webcam.

Step 2: Preprocess the image (crop, resize, normalize).

Step 3: Extract facial features using deep learning model.

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Step 4: Perform face recognition for identity verification.

Step 5: Perform facial expression analysis for emotion detection.

Step 6: Collect smartwatch health data and computer logs.

Step 7: Fuse all collected data for employee state evaluation.

Step 8: Detect abnormal conditions or policy violations.

Step 9: Generate alerts and notify HR dashboard.

Algorithm Pseudocode

START

Capture facial image from webcam

Collect health data from smartwatch

Collect computer usage logs

Preprocess facial image

Extract facial features using MTDL model

Perform face recognition

Perform emotion analysis

IF employee identity is valid THEN

Continue monitoring

ELSE

Generate unauthorized access alert

END IF

Analyze health parameters

Analyze computer activity logs

IF abnormal health OR stress OR policy violation detected THEN

Generate alert

Send notification to HR dashboard

END IF

Store monitoring results in database

STOP

VII. CONCLUSION

7.1. CONCLUSION

In conclusion, this project presents a Smart Employee Monitoring System using IoT and Multitask Deep Learning technologies to improve workplace safety, employee well-being, productivity, and organizational security. The system integrates smartwatch-based health monitoring, facial recognition, facial expression analysis, and computer usage monitoring into a unified intelligent platform. The proposed system uses the Multitask Deep Learning (MTDL) algorithm for simultaneous employee identity verification and emotion detection, while anomaly detection and rule-based monitoring algorithms are used to identify abnormal health conditions, stress, fatigue, unauthorized access, and risky system activities. The system continuously collects physiological parameters such as heart rate, body temperature, and blood pressure using IoT smartwatches and combines them with facial analysis and computer log monitoring to evaluate the overall employee state in real time. Automated alerts and notifications are generated whenever abnormal conditions or policy violations are detected, enabling HR personnel to take timely preventive or corrective actions. The proposed solution

provides an efficient, secure, and scalable approach for intelligent employee monitoring and supports proactive workplace management through real-time analysis and AI-driven decision-making.

7.2. FUTURE ENHANCEMENT

1. Smart Workplace Environment Control

The system can be enhanced by integrating smart office automation features such as automatic lighting, temperature control, and workspace adjustments based on employee stress levels and health conditions. This can help create a more comfortable and productive working environment.

2. Employee Safety Emergency Response System

Future versions of the system can include automatic emergency response mechanisms that instantly contact medical staff or emergency services when severe health abnormalities such as extremely high heart rate or sudden unconscious behavior are detected.

3. Personalized Workload Recommendation System

An intelligent recommendation module can be added to analyze employee stress, fatigue, and productivity patterns to suggest workload balancing, break schedules, or task adjustments automatically. This can help reduce burnout and improve employee performance and mental well-being.

IX. REFERENCES

[1] B. Trenerry, S. Chng, Y. Wang, Z. S. Suhaila, S. S. Lim, H. Y. Lu, and P. H. Oh, “Preparing workplaces for digital transformation: An integrative review and framework of multi-level factors,” Frontiers Psychol., vol. 12, Art. no. 620766, 2021.

[2] A. Ullrich, M. Reißig, S. Niehoff, and G. Beier, “Employee involvement and participation in digital transformation: A combined analysis of literature and practitioners’ expertise,” J. Organizational Change Manage., vol. 36, no. 8, pp. 29–48, 2023.

[3] J. Selimović, A. Pilav-Velić, and L. Krndžija, “Digital workplace transformation in the financial service sector: Investigating the relationship between employees’ expectations and intentions,” Technol. Soc., vol. 66, Art. no. 101640, 2021.

[4] A. Bregenzer and P. Jimenez, “Risk factors and leadership in a digitalized working world and their effects on employees’ stress and resources,” J. Med. Internet Res., vol. 23, no. 3, Art. no. e24906, 2021.

[5] G. Mazzuto, S. Antomarioni, G. Marcucci, F. E. Ciarapica, and M. Bevilacqua, “Learning-by-doing safety and maintenance practices: A pilot course,” Sustainability, vol. 14, no. 15, p. 9635, 2022.

[6] M. Juchnowicz and H. Kinowska, “Employee well-being and digital work during the COVID-19 pandemic,” Information, vol. 12, no. 8, p. 293, 2021.

[7] T. Moe-Byrne, J. Shepherd, D. Merecz-Kot, M. Sinokki, P. Naumanen, L. Hakkaart-van Roijen, and C. Van Der Feltz-Cornelis, “Effectiveness of tailored digital health interventions for mental health at the workplace,” PLOS Digit. Health, vol. 1, no. 10, Art. no. e0000123, 2022.

[8] A. Dudezert, F. Laval, A. Shirish, and N. Mitev, “When companies make your day: Happiness management and digital workplace transformation,” J. Global Inf. Manage., vol. 31, no. 5, pp. 1–35, 2023.

[9] B. Schneider, M. G. Ehrhart, and W. H. Macey, “Organizational climate and culture,” Annu. Rev. Psychol., vol. 64, no. 1, pp. 361–388, 2013.

[10] L. R. James, C. C. Choi, C.-H.-E. Ko, P. K. McNeil, M. K. Minton, M. A. Wright, and K.-I. Kim, “Organizational and psychological climate: A review of theory and research,” Eur. J. Work Organizational Psychol., vol. 17, no. 1, pp. 5–32, 2008.

[11] Z. Avtalion, I. Aviv, I. Hadar, G. Luria, and O. Bar-Gil, “Digital infrastructure as a new organizational digital climate dimension,” Appl. Sci., vol. 14, no. 19, p. 8592, 2024.

[12] L. Martin, L. Hauret, and C. Fuhrer, "Digitally transformed home office impacts on job satisfaction, job stress and job productivity," PLoS ONE, vol. 17, no. 3, Art. no. e0265131, 2022.

[13] M. Eken and H. Aydin, "Mapping digital competency for digital immigrants: A comparative analysis in the case of Turkey, Germany, and Spain," Erciyes J. Educ., vol. 6, no. 1, pp. 66–79, 2022.

[14] I. Manor and R. Kampf, "Digital nativity and digital diplomacy: Exploring conceptual differences between digital natives and digital immigrants," Global Policy, vol. 13, no. 4, pp. 442–457, 2022.

[15] J. M. Beus, J. H. Smith, and E. C. Taylor, "Integrating organizational climate theory: A domain-independent explanation for climate formation and function," J. Appl. Psychol., vol. 108, no. 12, pp. 2018–2039, 2023.

[16] J. Thileepan and T. Raveendran, "Impact of digital transformation on employee engagement," J. Manage. Matters, vol. 9, no. 1, pp. 53–81, 2022.

[17] A. Barbuto, A. Gilliland, R. Peebles, N. Rossi, and T. Shrout, "Telecommuting: Smarter Workplaces," 2020.

[18] V. Scuotto, M. Nicotra, M. Del Giudice, N. Krueger, and G. L. Gregori, "A micro foundational perspective on SMEs' growth in the digital transformation era," J. Bus. Res., vol. 129, pp. 382–392, 2021.

[19] C. J. Siregar and A. F. Hendarman, "Increasing employee performance through digital culture, compensation, career development and employee resilience," Int. J. Current Sci. Res. Rev., vol. 6, no. 1, pp. 1–16, 2023.

[20] P. Valkonen, S. Kujala, I. Hörhammer, K. Savolainen, R.-R. Helminen, and I. Vartia, "Health self-management of older employees," Finnish J. eHealth eWelfare, vol. 15, no. 2, pp. 1–14, 2023.

[21] B. Balgiu, "The adaptation and validation of the techno-work engagement scale (TechnoWES-9)," Psihologia Resurselor Umane, vol. 20, no. 2, pp. 1–12, 2022.

[22] Y. Wang, "Analyzing the mechanism of strategic orientation towards digitization and organizational performance," Frontiers Psychol., vol. 13, Art. no. 1006310, 2022.

[23] S. Bhiwaniwala, V. Bansal, B. Singla, N. Malarout, S. Vaz, P. Hegde, N. S. Tatkar, and A. Sharma, "Impact analysis of work culture and transformation during COVID-19," J. Comput., Mech. Manage., vol. 1, no. 1, pp. 48–59, 2022.

[24] A. L. Strauss and J. Corbin, Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory. Newbury Park, CA, USA: Sage, 1998.

[25] J. P. Gerlach and R. T. Cenfetelli, "Constant checking is not addiction: A grounded theory of IT-mediated state-tracking," MIS Quart., vol. 44, no. 4, pp. 1705–1732, 2020.

[26] N. Pandit, "The creation of theory: A recent application of the grounded theory method," Qualitative Rep., vol. 2, no. 4, pp. 1–14, 1996.

[27] B. G. Glaser, "Conceptualization: On theory and theorizing using grounded theory," Int. J. Qualitative Methods, vol. 1, no. 2, pp. 23–38, 2002.

[28] G. Walsham, "Doing interpretive research," Eur. J. Inf. Syst., vol. 15, no. 3, pp. 320–330, 2006.

[29] R. Arizon-Peretz, I. Hadar, G. Luria, and S. Sherman, "Understanding developers' privacy and security mindsets via climate theory," Empirical Softw. Eng., vol. 26, no. 6, pp. 1–43, 2021.

[30] J. Saldana, The Coding Manual for Qualitative Researchers, 2nd ed. Newbury Park, CA, USA: Sage, 2013.

[32] Deep Learning – Ian Goodfellow, Yoshua Bengio, Aaron Courville, MIT Press, 2016.

[33] Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow – Aurélien Géron, O'Reilly Media, 2019.

[34] Artificial Intelligence: A Modern Approach – Stuart Russell, Peter Norvig, Pearson Education, 2020.

[35] Internet of Things: Principles and Paradigms – Rajkumar Buyya, Amir Vahid Dastjerdi, Morgan Kaufmann, 2016.

[36] Learning OpenCV 4 Computer Vision with Python – Packt Publishing, 2020.

[37] Python for Data Analysis – Wes McKinney, O'Reilly Media, 2022.

[38] Machine Learning with Python – O'Reilly Media, 2017.

[39] Embedded Systems with ARM Cortex-M Microcontrollers – E-Man Press LLC, 2017.

[40] Data Mining: Concepts and Techniques – Jiawei Han, Micheline Kamber, Morgan Kaufmann, 2011.

[41] Computer Vision: Algorithms and Applications – Springer, 2022.

[42] OpenCV Official Documentation – https://docs.opencv.org/

[43] TensorFlow Official Website – https://www.tensorflow.org/

[44] PyTorch Official Website – https://pytorch.org/

[45] OpenCV GitHub Repository – https://github.com/opencv/opencv

[46] TensorFlow GitHub Repository – https://github.com/tensorflow/tensorflow

[47] PyTorch GitHub Repository – https://github.com/pytorch/pytorch

[48] OpenCV Python Tutorials – https://docs.opencv.org/4.x/d6/d00/tutorial_py_root.html

[49] OpenCV Python Package (PyPI) – https://pypi.org/project/opencv-python/

[50] TensorFlow Machine Learning Research Paper – https://arxiv.org/abs/1603.04467

[51] PyTorch Installation Guide – https://pytorch.org/get-started/locally/