AI-Powered Compliance Monitoring for Retail Staff

System Requirements Specification

Group 4

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COS40005 – Computing Technology Project A, Semester 3, May 2024

DOCUMENT CHANGE CONTROL

Version	Date	Authors	Summary of Changes
1	20/06/2024	Nguyen Dang Khanh Toan	Initialized the document
2	05/07/2024	Nguyen Ha Huy Hoang	Revised Introduction
3	07/07/2024	Nguyen Cuong Nhat	Updated Purpose and Scope
4	09/07/2024	Nguyen Dang Duc Anh	Added Definitions section
5	10/07/2024	Vuong Khang Minh	Final review and adjustments

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Name	Position	Signature	Date
Vuong Khang Minh	Document Researcher, Document Organizer, AI Specialist		10/7/2024
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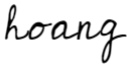
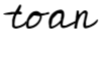
Nguyen Ha Huy Hoang	Team leader/Project Manager		10/7/2024
Nguyen Dang Khanh Toan	Quality Assurance, Domain Expert, Software Specialist		10/7/2024
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1. Introduction

This document describes the requirements for the " Employee Compliance Checke " - a software system designed to enhance employee monitoring in retail environments. By collecting and analyzing CCTV feeds, the system will monitor employee compliance, generate detailed reports, and provide timely notifications. This System Requirements Specification (SRS) will guide developers in building the software to meet these objectives.

1.1. Purpose

The purpose of this SRS is to outline the functionality and performance criteria of the Employee Compliance Checker. It serves as a detailed guide for project stakeholders, developers, and testers to ensure that the software meets the intended requirements and expectations..

1.2. Scope

The Employee Compliance Checker project focuses on enhancing compliance monitoring in retail environments through the use of AI and video analysis technologies.

Boundaries of the Project:
The project is confined to the development and deployment of a software system that integrates with existing CCTV systems in retail environments. It will focus exclusively on monitoring employee behavior within the retail setting and generating compliance reports.

System Name: Employee Compliance Checker

What the Project Will Accomplish:

- Collect and process recorded CCTV feeds from retail environments.
- Utilize AI algorithms to analyze employee behavior and identify compliance with company policies.
- Generate detailed compliance reports for management review.
- Support a user-friendly interface for easy navigation and operation by store managers and compliance officers.

What the Project Will Not Accomplish:

- Perform real-time intervention or corrective actions.
- Replace existing physical security systems.
- Include facial recognition or personal identification features.
- Operate outside the scope of retail environments or employee monitoring.

Applications and Benefits:
The Employee Compliance Checker will be used in retail stores to ensure employees follow company policies. By providing real-time monitoring and detailed reports, the system helps managers identify and address compliance issues promptly. This leads to improved operational efficiency, better adherence to policies, and a higher level of customer satisfaction.

1.3. Definitions, Acronyms and Abbreviations

- **AI**: Artificial Intelligence
- **CCTV**: Closed-Circuit Television
- **GUI**: Graphical User Interface
- **HTTP**: HyperText Transfer Protocol
- **SRS**: System Requirements Specification
- **API**: Application Programming Interface
- **Compliance Report**: A document generated by the system summarizing the compliance status and incidents.
- **Retail Environment**: The physical location of retail operations where the system is implemented.

2. Overall Description

This section discusses the context of the Employee Compliance Checker, summarizing its features, system requirements, acceptance criteria, and the documentation to be delivered along with the software.

Context of the System:

- **New System**: The Employee Compliance Checker is a newly developed software system, not an upgrade or replacement of an existing product.
- **Complete System**: It is a complete solution designed to operate independently, although it can integrate with existing CCTV infrastructure in retail stores.

2.1. Product Features

The Employee Compliance Checker includes the following significant features at a high level:

- **AI-Powered Behavior Analysis**: Utilizes AI algorithms to monitor and analyze employee behavior in real-time.
- **Compliance Reporting**: Generates detailed reports summarizing compliance with company policies.
- **Real-Time Alerts**: Provides immediate notifications for critical compliance violations.
- **User-Friendly Interface**: Easy-to-navigate interface for store managers and compliance officers.
- **Data Privacy and Security**: Ensures compliance with relevant data protection regulations.

2.2. System Requirements

Hardware:

- CCTV cameras with digital output, should be full HD and higher.
- Jetson AGX Xavier 64GB for fast edge computing, fast local response.
- DGX H100 for parallel processing and AI/ML production.

- AMD EPYC 9684X for handling requests, IO tasks and fast computation.
- ECC 2TB for better cache storage, reducing memory corruption.
- 8TB NVMe for fast read and fast write, which is pretty crucial for massive input data (ex: videos, images, etc).

Software:

- Operating System: Windows Server 2016 or later / Ubuntu 18.04 or later
- Web Server: Apache 2.4 / Nginx
- Database: MySQL 5.7 or later
- Browser: Chrome, Firefox, Edge

2.3. Acceptance Criteria

The major acceptance criteria for the Employee Compliance Checker are:

- **Functionality:** The system must accurately monitor and analyze employee behavior, generating reliable compliance reports and real-time alerts.
- **Usability:** The interface must be intuitive and user-friendly, enabling easy navigation and operation by store managers and compliance officers.
- **Performance:** The system must process video feeds in real-time without significant latency and handle large volumes of data efficiently.
- **Security:** The system must ensure data privacy and security, complying with relevant regulations.
- **Integration:** The system must integrate seamlessly with existing CCTV infrastructure and optionally with larger retail management systems.

2.4. Documentation

The following documents will be delivered along with the software:

- **User Manual:** A complete guide for end-users detailing how to use the system.
- **Technical Manual:** Detailed documentation for developers and IT staff on the system's architecture, installation, and maintenance.
- **Tutorials:** Step-by-step tutorials for common tasks and features.
- **API Documentation:** Detailed documentation of the system's APIs for integration with other systems.
- **Compliance Reports:** Sample reports demonstrating the system's reporting capabilities.

3. Functional Requirements

3.1. Tasks

Task 1: Camera Feed Collection	
Purpose	To collect camera feed, preprocess and send to the server for analysis
Trigger/Precondition	Employees have been informed of the compliance check policy. The manager has a checklist of compliance check requirements.
Frequency	Regularly scheduled checks by the manager or random checks.
Critical	System unable to collect and process camera feed
Subtasks	Solutions
Collect feeds from camera	Cameras are to be placed at advantageous location and their feeds are to be sent to a central computer and a server (Jetson nano)
Preprocess feeds from camera **Problems:** Different camera could have different setting/type of video produced	Video feed should be preprocessed to reduced sized, change type …
Send video feed to server	Feeds after processed is sent to the server for analysis

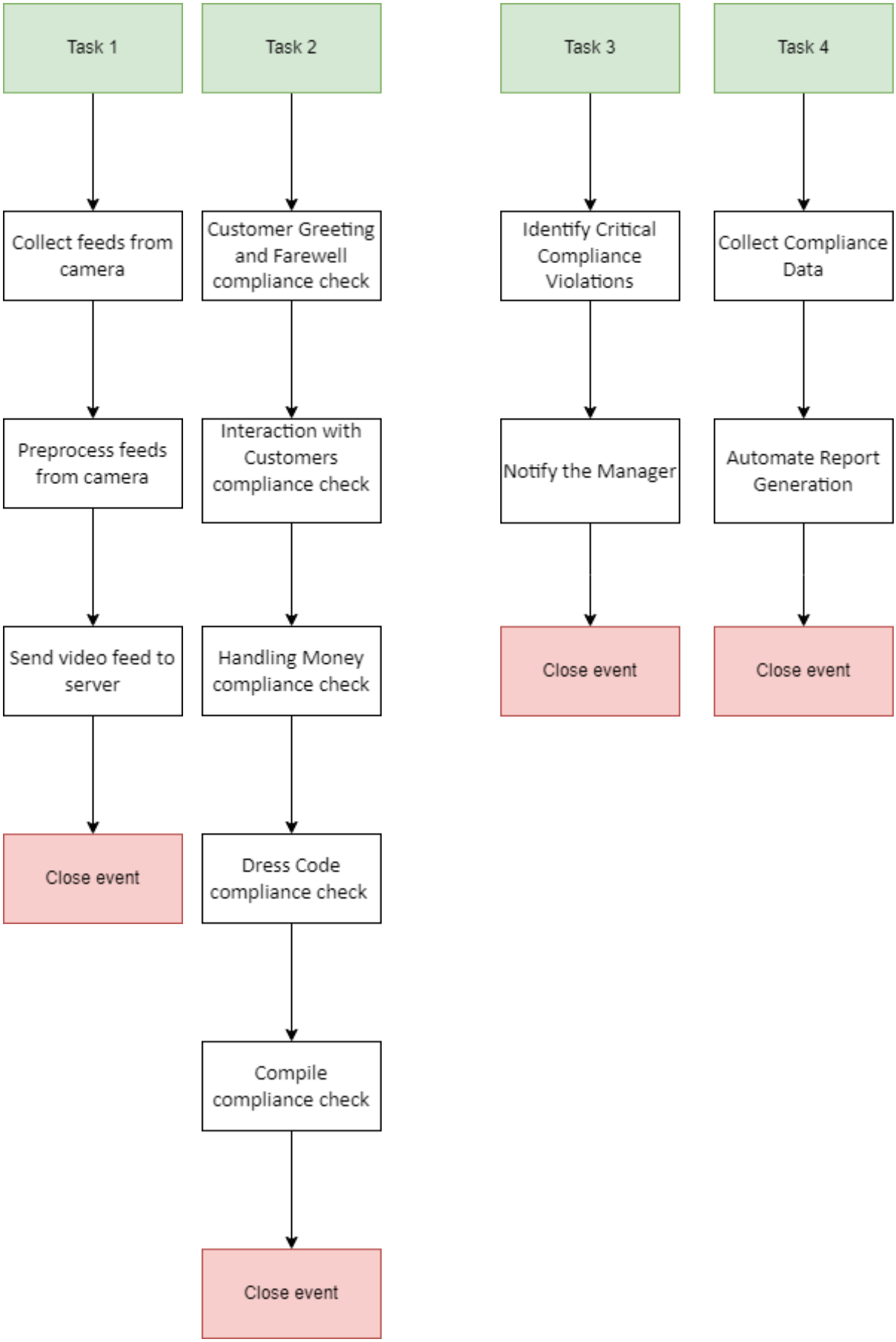
Task 2: Employee Analysis	
Purpose	Using video feeds to analyze employee behaviour to check compliance adherence
Trigger/Precondition	Video feed provided
Frequency	Maximum 20s/video chunk
Critical	A large amount of video feeds
Subtasks	Solutions
Customer Greeting and Farewell compliance check	Action Recognitions
Interaction with Customers compliance check	Action Recognitions
Issuing Bills compliance check	Action Recognitions
Handling Money compliance check	Action Recognitions
Dress Code compliance check	Object Detections
Compile compliance check	Compile the results from compliance checks and send to database for storage

Task 3: Notifications	
Purpose	Notify the manager and/or the employee when a critical compliance violation (error) is made
Trigger/Precondition	Video feeds had been analyzed on the server and compliance had been catergorized based on severity
Frequency	As soon as there is a critical compliance violation
Critical	Analysis failed or a large amount of video feeds that affects the performance
Subtasks	Solutions
Identify Critical Compliance Violations	Based on the analysis and given criteria, identify the critical compliances.

Notify the Manager **Problem:** Failed notifications	Automatically alerts the manager when critical compliance via the web app
Variation	
Notify the Employee	Automatically alerts the employee when critical compliance via the web app

Task 4: Generate Report	
Purpose	Generate daily report
Trigger/Precondition	Compliance checks have been conducted throughout the day.
Frequency	Daily
Critical	None, the report generator function does not affect the whole system
Subtasks	Solutions
Collect Compliance Data	Compiles the data from the analyzed video feeds in a 24 hours period
Automate Report Generation	Use API to generate report and send to the manager

3.2. Workflow


Task 1
Task 2
Task 3
Task 4
Collect feeds from camera
Customer Greeting and Farewell compliance check
Identify Critical Compliance Violations
Collect Compliance Data
Preprocess feeds from camera
Interaction with Customers compliance check
Notify the Manager
Automate Report Generation
Send video feed to server
Handling Money compliance check
Close event
Close event
Close event
Dress Code compliance check
Compile compliance check
Close event

4. Non-Functional (Quality) Requirements

The non-functional requirements for the Employee Compliance Checker system are based on the ISO/IEC 25010 quality model, ensuring a thorough evaluation of the system's quality attributes. These requirements are essential for the system's performance, usability, reliability, security, availability, scalability, maintainability, portability, and compliance, and they must be verifiable to ensure they are met during the testing stage.

4.1. Security

Dealing with customer personal information and CCTV footage makes security paramount for the system. Prioritizing security is necessary to protect sensitive data and ensure compliance with regulations (Wang, 2023).

Requirements:

- End-to-End Encryption: Implement end-to-end encryption for all data transmissions using AES-256. Verification: Security testing and encryption validation.
- Multi-Factor Authentication (MFA): Use MFA for all administrative access. Verification: Authentication testing and security audits.
- Data Anonymization: Anonymize user and employee data, ensuring at least 95% of personal data is anonymized. Verification: Data anonymization validation and compliance checks.
- Patch Management: Apply security patches within 48 hours of release. Verification: Patch management tracking and audits.
- Security Audits and Penetration Testing: Conduct quarterly security audits and penetration testing. Verification: Security audit reports and penetration test results.

4.2. Availability

The service should be always available to accommodate users anytime (Bai et al., 2022). Maintenance should be scheduled during non-peak hours (Pater et al., 2022).

Requirements:

- System Health Monitoring: Monitor system health continuously, generating alerts for any downtime exceeding 1 minute. Verification: System monitoring and alert logs.
- Backup and Disaster Recovery: Implement a robust backup and disaster recovery plan with daily backups and an RPO of 24 hours. Verification: Backup and recovery testing.
- System Uptime: Achieve a minimum system uptime of 99.5%. Verification: Uptime monitoring reports.

4.3. Performance

The system should process video feeds in real-time with minimal delay, providing timely notifications and reports to users.

Requirements:

- Video Feed Latency: Process video feeds with a latency of less than 1 second for 95% of feeds. Verification: Performance testing and latency measurement.
- User Interaction Response Time: Ensure a response time of less than 2 seconds for 90% of user interactions in the GUI. Verification: Response time testing and user interaction logs.
- Peak Traffic Handling: Handle peak traffic loads with a response time of less than 5 seconds for 95% of requests. Verification: Load testing and response time analysis.
- Concurrent Video Feeds: Optimize algorithms to handle at least 100 concurrent video feeds without performance degradation. Verification: Concurrent processing tests and performance benchmarks.

4.4. Usability

The GUI should be intuitive and easy to navigate, ensuring that users can efficiently access and utilize the system's functionalities.

Requirements:

- Usability Testing: Conduct usability testing with at least 20 users per quarter, incorporating feedback to achieve a usability satisfaction score of 4.5 out of 5. Verification: Usability test reports and satisfaction surveys.
- Responsive Design: Implement a responsive design that works well on various devices and screen sizes, with a goal of 95% compatibility. Verification: Compatibility testing across devices.
- Accessibility Compliance: Ensure accessibility compliance to accommodate users with disabilities, aiming for a compliance score of AA. Verification: Accessibility testing and compliance audits.

4.5. Reliability

The system must be dependable, with consistent performance and minimal errors, ensuring users can rely on it for continuous operation.

Requirements:

- Redundancy and Failover: Implement redundancy and failover mechanisms to handle hardware or software failures, with a failover time of less than 30 seconds. Verification: Failover testing and redundancy checks.
- Data Integrity: Ensure data integrity through regular checks, with 99.99% data accuracy. Verification: Data integrity testing and audit logs.
- Mean Time Between Failures (MTBF): Achieve a mean time between failures (MTBF) of at least 1000 hours. Verification: Reliability testing and MTBF calculation.

4.6. Scalability

The system should be able to scale to accommodate an increasing number of CCTV feeds and users without compromising performance.

Requirements:

- System Architecture: Design the system architecture to support horizontal and vertical scaling, accommodating a 100% increase in user load annually. Verification: Scalability testing and architectural reviews.
- Load Balancing: Use load balancing to distribute traffic evenly across servers, maintaining performance within 95% of baseline metrics. Verification: Load balancing tests and performance metrics.
- Database Performance: Implement database partitioning and indexing to handle large datasets efficiently, ensuring query response times under 2 seconds for 95% of queries. Verification: Database performance tests and query response time measurements.

4.7. Maintainability

The system should be easy to maintain, with clear documentation and a modular design to facilitate updates and enhancements.

Requirements:

- Modular Architecture: Use a modular architecture to separate concerns and simplify updates. Verification: Code reviews and modularity assessments.
- Documentation: Maintain up-to-date documentation for both the system and its components, with updates made within 5 days of any change. Verification: Documentation reviews and update logs.
- Coding Standards and Best Practices: Follow coding standards and best practices to ensure code quality, achieving a code quality score of 4.5 out of 5 in code reviews. Verification: Code quality reviews and adherence checks.
- Automated Testing: Implement automated testing covering at least 80% of the codebase to quickly identify and fix issues. Verification: Automated test coverage reports and test results.

4.8. Portability

The application should be available across multiple platforms, providing a consistent user experience and saving time and cost on development.

Requirements:

- Web-Based Version: Provide a web-based version for desktop users, with 90% feature compatibility with mobile versions. Verification: Cross-platform testing and feature compatibility checks.
- App Size: Ensure the app does not take up more than 200MB of space on users' devices. Verification: App size checks and storage usage reports.

4.9. Compliance

The system must comply with relevant regulations and industry standards to ensure legal and ethical operation.

Requirements:

- Data Protection Laws: Adhere to data protection laws regarding the collection, storage, and processing of personal data, ensuring 100% compliance. Verification: Compliance audits and legal reviews.
- Industry Standards: Follow industry standards for video surveillance and data security, achieving at least 95% adherence to relevant standards. Verification: Standard compliance checks and audit reports.
- Compliance Policy Reviews: Regularly review and update compliance policies to reflect changes in legislation, conducting reviews bi-annually. Verification: Policy review logs and compliance update reports.

5. Interface Requirements

5.1. System in Context

Employee Compliance Checker is designed to interact seamlessly with retail environments to enhance employee monitoring. The system processes video feeds from CCTV cameras installed within the retail space. It analyzes employee behavior based on predefined compliance criteria and communicates results via a web-based interface to store managers and relevant stakeholders.

System Diagram

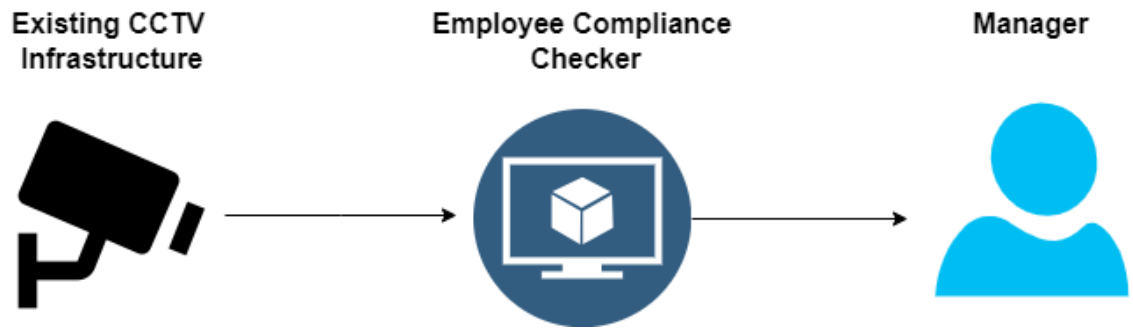


Figure 1. Employee Compliance Checker System

5.2. User Interfaces

The Employee Compliance Checker provides a web-based GUI for store managers to interact with the system. This interface includes the following features to each stores respectively:

- **Dashboard:** Displays real-time data and compliance status.
- **Compliance Reports:** Provides detailed reports on employee compliance.
- **Settings:** Enables configuration of system parameters and compliance criteria.

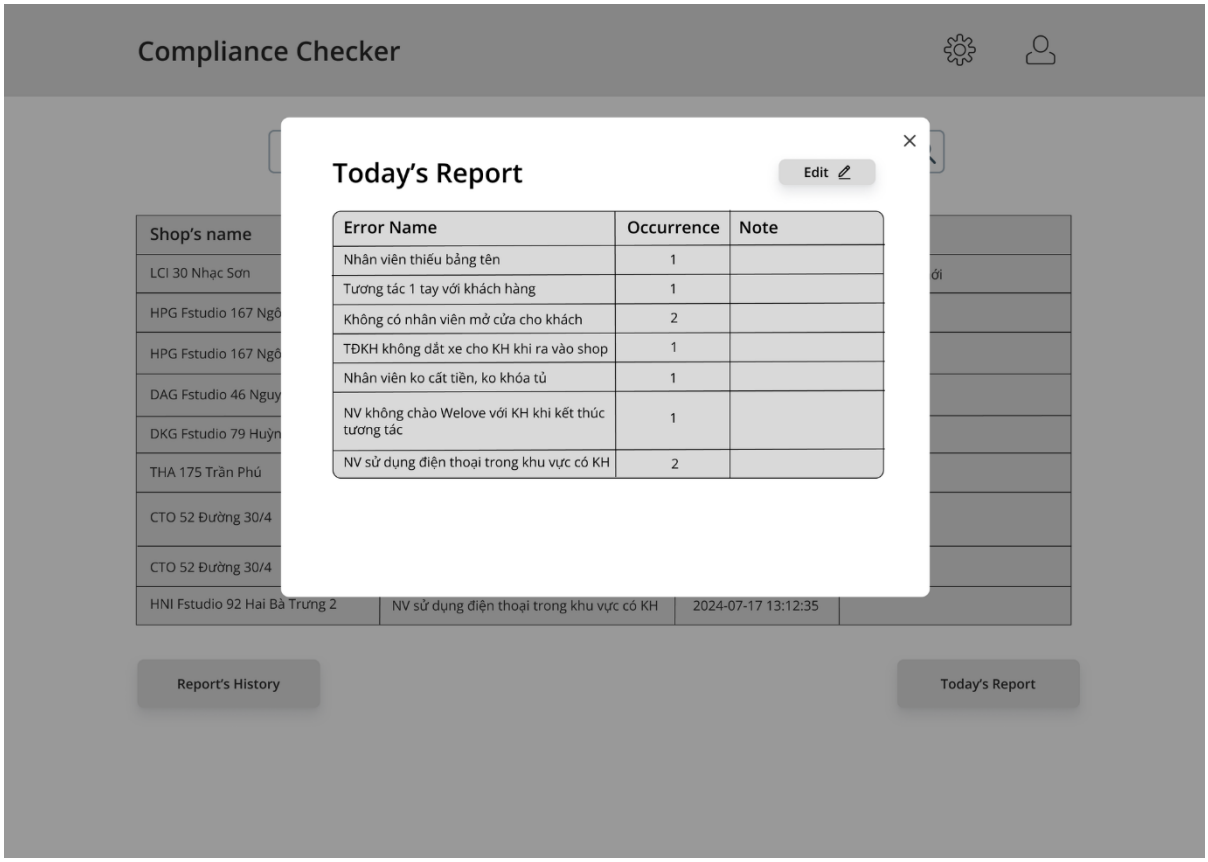


Figure 2. Image of the compliance report.

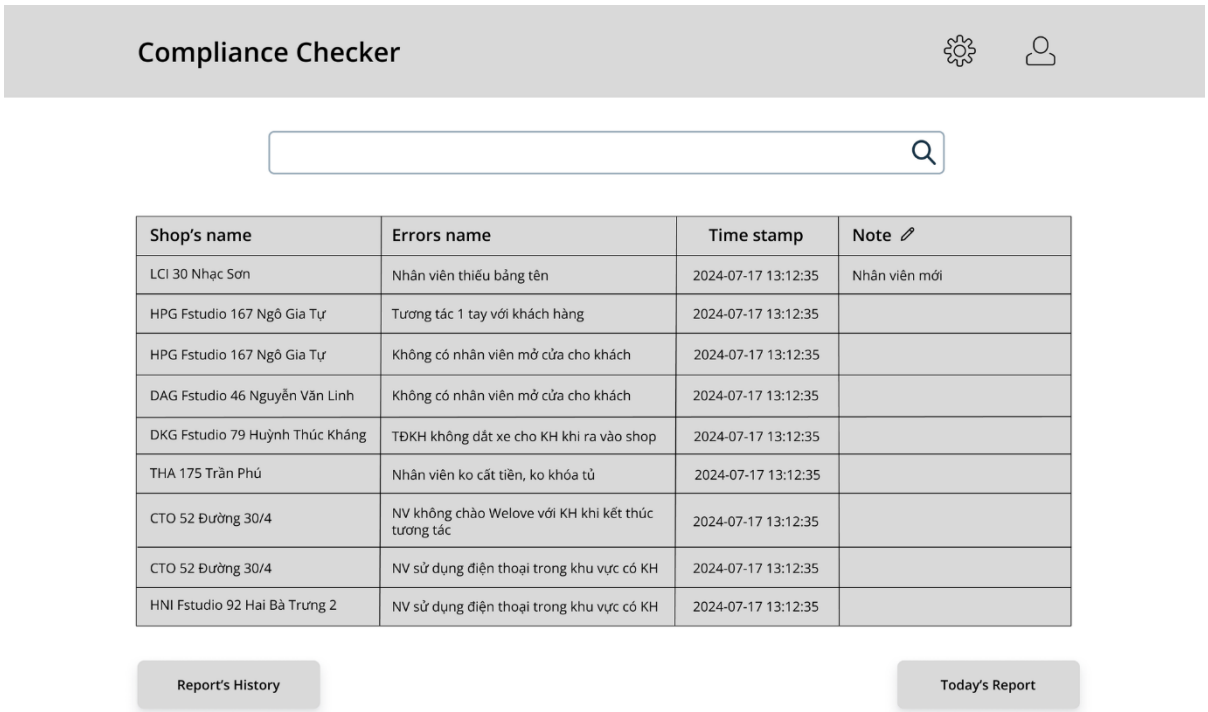


Figure 3. Image of the dashoard.

5.3. Hardware Interfaces

- **CCTV Cameras:** Full HD or higher digital output. Cameras should be compatible with the software and able to stream video in real-time.

- **Edge Computing Device (**Jetson AGX Xavier 64GB)**:** This device will be used for fast edge computing and local response. The software should be capable of interacting with the Jetson AGX Xavier to perform initial processing of video feeds before sending them to the central server for further analysis.

- **Central Processing Units:**
  - **DGX H100:** Used for parallel processing and AI/ML production. The software should be designed to offload intensive computation tasks to the DGX H100 to ensure efficient processing of large datasets.
  - **AMD EPYC 9684X**: Handles requests, IO tasks, and fast computation. The software should efficiently distribute tasks to leverage the processing power of AMD EPYC 9684X.

- **Memory and Storage**:
  - **ECC 2TB:** Used for better cache storage, reducing memory corruption. The software should manage cache effectively to optimize performance.
  - **8TB NVMe**: Used for fast read and write operations, crucial for handling massive input data such as videos and images. The software should be capable of handling high I/O operations to store and retrieve data quickly.

5.4. Software Interfaces

The Employee Compliance Checker interfaces with various software applications to ensure reliable performance:

- **Operating Systems**: Windows Server 2016 or later / Ubuntu 18.04 or later. The software must be compatible with these operating systems to ensure reliable performance.
- **Web Server**: Apache 2.4 / Nginx. The software will interact with these web servers to handle HTTP requests and serve the web-based GUI to users.
- **Database**: MySQL 5.7 or later. The software will use MySQL for storing and retrieving compliance data, configuration settings, and logs. The interaction will involve executing SQL queries and managing database connections efficiently.
- **Browsers**: Chrome, Firefox, Edge. The web-based GUI should be compatible with these browsers to ensure a consistent user experience across different platforms.

5.5. Communication Interfaces

The communication interfaces for the Employee Compliance Checker involve the protocols and methods used for data exchange within the system. These include:

- **Local Area Network Communication**: The software should be capable of communicating over a local network to interact with CCTV cameras and edge computing devices.

- **Internet Communication**:

- HTTP/HTTPS: The software will use these protocols to transmit data between the server and client applications securely. All data transmissions must be encrypted using SSL/TLS to ensure data security and privacy.

6. References

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3. Pater, I., Reijns, A., & Mitici, M. 2022, Alarm-based Predictive Maintenance Scheduling for Aircraft Engines with Imperfect Remaining Useful Life Prognostics, Reliability Engineering & System Safety, viewed 8 July 2024, <https://www.sciencedirect.com/science/article/pii/S0951832022000175 >.