CONCEPT NOTE FOR AI-ENABLED HAZARD SURVEILLANCE PLATFORM

Version	Date	Changes	Author	Approver
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1. Purpose of the document :

This comprehensive document delineates the implementation scope of advanced Artificial Intelligence (AI) Solutions, leveraging the Arresto Connect+ platform, for the development and deployment of an automated hazard monitoring and risk mitigation system.

The document provides an in-depth analysis of the AI-driven software ecosystem designed to facilitate proactive safety interventions and early hazard detection through sophisticated unsafe act and condition surveillance protocols. The primary objective is to prevent workplace incidents, near-misses, and potential incidents through real-time monitoring and predictive analytics.

The salient features of the arresto AI platform are summarized below.

1. **Real-time Hazard detection:** Continuous monitoring and instant detection of unsafe acts, such as improper use of personal protective equipment (PPE), violation of safety protocols, or unauthorized access to restricted areas.
2. **Workplace Risk Assessment:** Automated analysis of workplace conditions, including detection of slip and trip hazards, assessment of air quality, noise levels, and other environmental factors that may pose risks to workmen safety.
3. **Behavioral Analysis:** AI-driven examination of workmen behaviors, to identify patterns that may lead to increased risks such as deviations to set behaviors, distractions, or non-compliance with defined procedures.
4. **Incident Prediction and Prevention:** Utilization of machine learning models to predict potential incidents based on historical data, current conditions, and identified risk factors.
5. **Automated Alert System:** Implementation of a hierarchical alert system that notifies appropriate personnel of detected hazards or predicted risks in real-time, enabling swift corrective action.
6. **Safety Performance Metrics**: Generation of comprehensive safety performance indicators and analytics dashboards for continuous improvement of safety management systems.
7. **Compliance Monitoring:** Automated tracking and reporting of real time behavioral violations with access to live feeds of all implemented sites at a central platform for utilizing observation summaries for various safety interventions and undertaking necessary escalations.

2. Product Introduction:

AI-enabled Camera System

Hazard detection to safeguard employees, assets and workplaces.

2.1 Description:

The compact, AI-powered camera. Equipped with high-resolution sensors and IP/ thermographic cameras, tackles complex management tasks while ensuring employee safety. Boost production quality, efficiency, and accuracy – all under one intelligent eye.

AI-powered system aims to revolutionize workplace safety by providing a proactive, data-driven approach to hazard mitigation. By leveraging advanced technologies, the platform enables safety professionals to transition from reactive incident management to predictive risk prevention, ultimately fostering a culture of safety and reducing the likelihood of workplace incidents and injuries.

2.2 Capabilities
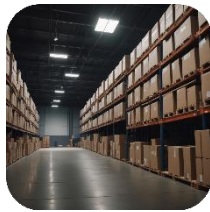
Warehouse Management

Workplace Unsafe & Hazardous Acts
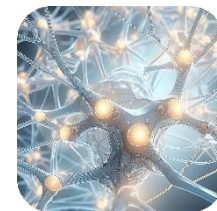

Access Control

Inspection (Quality Assurance)

Traffic/Parking Management
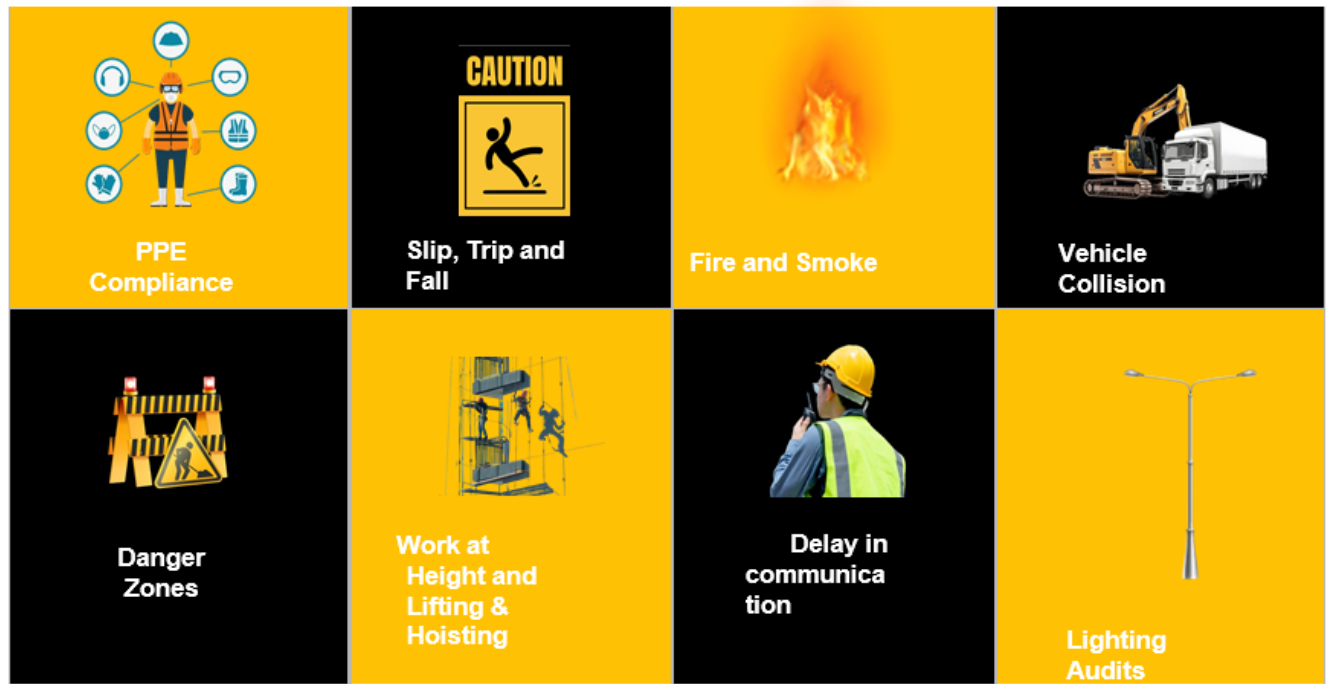

Asset Monitoring

Counting Solution

Customer AI Model Development

3. Workplace surveillance Overview

Workplace surveillance systems is a valuable tool in achieving OHSMS goals. The arresto AI modules maintain round the clock surveillance on workplace hazards .

The Challenge of Workplace Safety

▶ Accidents and injuries are expensive

▶ Direct medical expenses, lost productivity, and legal fees can significantly impact acompany's bottom line.

▶ Beyond the financial cost, workplace injuries can have a devastating human cost.

▶ Workers can suffer physical and emotional trauma, and families can be left struggling.

Responsible AI Surveillance Implementation

▶ Employees should be informed about the use of surveillance systems and the purposes forwhich they are used.

▶ Surveillance data should be stored securely and accessed only by authorized personnel.

▶ The ultimate goal of workplace surveillance should be to promote a safe and healthy workenvironment.

4. AI Infrastructure Overview

The proposed safety infrastructure leverages cutting-edge technologies to create a comprehensive, real-time safety monitoring and analytics system. The core components of this infrastructure are:

▸ **Advanced Computer Vision AI**

  ▸ Deep Learning Models:

  - Utilizes state-of-the-art convolutional neural networks (CNNs) and custom-designed architectures optimized for safety hazard detection.

  - Implements transfer learning techniques to adapt pre-trained models to specific workplace environments, enhancing accuracy and reducing training time.

  ▸ Multi-modal Fusion:

  • Integrates RGB video streams with camera sensors and advanced techniques for enhanced 3D scene understanding.

  • Incorporates thermal imaging techniques for detecting heat-related hazards and improving low-light performance.

  ▸ Real-time Processing:

  • Employs GPU acceleration for high-speed inference.

  • Utilizes edge computing devices (Hailo accelerators) for on-site processing to reduce latency and bandwidth requirements.

▸ **Hazard Detection Capabilities:**

  ▸ Personal Protective Equipment (PPE) Detection: Identifies missing or improperly worn safety gear (helmets, gloves, safety glasses, etc.) with >95% accuracy.

  ▸ Fall Detection: Uses pose estimation algorithms to detect workmen at risk of falling or working at heights without proper safety measures.

  ▸ Restricted Area Monitoring: Implements geo-fencing and object tracking to detect unauthorized access to dangerous zones.

  ▸ Equipment Malfunction Detection: Analyzes equipment operation patterns to identify anomalies indicative of potential malfunctions.

  ▸ Ergonomic Risk Assessment: Utilizes skeletal tracking to assess workmen postures and movements, flagging potential ergonomic issues.

▶ **Continuous Learning:**

▶ Implements federated learning techniques to improve model performance across multiple sites while preserving data privacy.

▶ Uses active learning algorithms to identify and prioritize ambiguous cases for human review, continuously improving model accuracy.

▶ **Real-time Alert System**

▶ Low-latency Notification Pipeline:

  • Utilizes a publish-subscribe architecture RabbitMQ for efficient event distribution.

  • Implements WebSocket protocols for real-time updates to web and mobile clients.

▶ Intelligent Alert Routing:

▶ Employs a rule-based engine combined with machine learning for dynamic alert prioritization and routing.

▶ Integrates with existing communication systems (email, SMS, push notifications) through RESTful APIs.

▶ Escalation Mechanisms:

▶ Implements time-based escalation protocols to ensure critical alerts are addressed promptly.

▶ Utilizes decision trees or Bayesian networks for intelligent escalation based on hazard severity and response time.

▶ **Data Analytics and Insights Engine**

▶ Big Data Processing:

  • Utilizes distributed computing frameworks Apache Spark for processing large volumes of safety data.

  • Implements data lake architecture cloud solution AWS S3 for efficient storage and retrieval of historical data.

▶ Advanced Analytics:

  • Time Series Analysis: Applies ARIMA, Prophet and LSTM models for trend analysis and forecasting of safety incidents.

- Anomaly Detection: Utilizes isolation forests or autoencoders to identify unusual patterns in safety data.
- Causal Inference: Implements causal inference techniques (e.g., propensity score matching, difference-in-differences) to assess the impact of safety interventions.

▶ Machine Learning for Predictive Analytics:

- Develops ensemble models (Random Forests, Gradient Boosting Machines) for predicting high-risk periods or locations.
- Implements reinforcement learning algorithms to optimize safety recommendation systems.
- Utilizes sentiment analysis to gauge workmen perceptions of safety measures.

▶ **Visualization and Reporting**

▶ Interactive Dashboards:

- Develops responsive web applications using modern frameworks for real-time data visualization.

▶ Automated Reporting:

- Utilizes business intelligence tools for generating customizable reports.
- Implements natural language generation algorithms to produce human-readable summaries of safety trends and insights.

▶ **System Integration and Scalability**

▶ Microservices Architecture:

- Designs a modular system using containerization (Docker) and orchestration (Kubernetes) for easy scaling and deployment.
- Implements service mesh technologies for enhanced inter-service communication and security.

▶ API-First Design:

- Develops RESTful APIs for seamless integration with existing enterprise systems (ERP and CMMS).
- Implements OAuth 2.0 and JWT for secure API authentication and authorization.

▶ Cloud-Native Design:

- Leverages cloud services (AWS) for scalable and resilient infrastructure.
- Implements auto-scaling and load balancing to handle varying workloads efficiently.

The proposed privacy infrastructure is designed to ensure the highest standards of data protection, security, and compliance while enabling effective safety monitoring. This comprehensive approach incorporates state-of-the-art technologies and methodologies:

- **Privacy-Preserving Data Processing**
  - Data Minimization:
    - Implements dynamic data sampling techniques to reduce the volume of processed data while maintaining statistical significance.
    - Utilizes edge computing for initial data processing, transmitting only relevant, anonymized insights to central systems.
  - Anonymization and Pseudonymization:
    - Employs k-anonymity, l-diversity, and t-closeness models to ensure robust anonymization of personal data.
    - Implements differential privacy techniques with carefully calibrated epsilon values to add controlled noise to aggregate data, preventing individual identification.
  - Federated Learning:
    - Utilizes federated learning frameworks to train AI models without centralizing raw data.
    - Implements secure aggregation protocols to protect individual contributions during model updates.
  - Privacy-Preserving Computer Vision:
    - Applies real-time object detection to identify and blur faces and other personally identifiable information (PII) in video streams.
    - Utilizes adversarial machine learning techniques to generate privacy-preserving representations of individuals for safety monitoring.

- **Enhanced Security with Access Control**
  - Multi-Factor Authentication (MFA):
    - Implements FIDO2-compliant authentication protocols for password less, phishing-resistant access.
    - Utilizes biometric authentication facial recognition or fingerprint combined with hardware security keys for high-security areas.
  - Role-Based Access Control (RBAC):
    - Develops a fine-grained RBAC system using attribute-based access control (ABAC) principles for

dynamic permission management.

- Implements just-in-time (JIT) and just-enough-access (JEA) principles to minimize standing privileges.

▶ Single Sign-On (SSO):

- Integrates with enterprise identity providers using SAML 2.0 or OpenID Connect protocols.
- Implements SCIM (System for Cross-domain Identity Management) for automated user provisioning and deprovisioning.

▶ Privileged Access Management (PAM):

- Utilizes a vault system for secure storage and rotation of access credentials.
- Implements session recording and keystroke logging for all privileged access, with tamper-evident storage.

▶ **Data Security (ISO 27001/SOC 2 Compliant)**

▶ Encryption:

- Implements AES-256 encryption for data at rest, utilizing hardware security modules (HSMs) for key management.
- Employs TLS 1.3 with perfect forward secrecy (PFS) for all data in transit.
- Utilizes homomorphic encryption techniques for processing sensitive data without decryption.

▶ Secure Data Storage:

- Implements a multi-tiered storage architecture with separate encryption keys for each tier.
- Utilizes write-once-read-many (WORM) storages for immutable audit logs and critical safety data.
- Implements data versioning and soft delete mechanisms with configurable retention policies.

▶ Network Security:

- Deploys next-generation firewalls (NGFW) with deep packet inspection and threat intelligence integration.
- Implements micro-segmentation using software-defined networking (SDN) to isolate critical system components.
- Utilizes a zero-trust network architecture with continuous authentication and authorization.

▶ Vulnerability Management:

- Conducts regular automated vulnerability scans using tools like Nessus or Qualys.

- Implements a bug bounty program for crowdsourced security testing.

- Utilizes static and dynamic application security testing (SAST/DAST) in the development pipeline.

▶ **Data Storage and Retention**

▶ Intelligent Data Reduction:

- Implements content-aware compression algorithms to reduce storage requirements while preserving critical information.

- Utilizes machine learning-based data deduplication to identify and eliminate redundant data across storage systems.

▶ Hierarchical Storage Management (HSM):

- Develops an automated tiered storage system that moves data between high-performance SSD arrays and lower-cost object storage based on access patterns and criticality.

- Implements information lifecycle management (ILM) policies for automated data archiving and deletion.

▶ Customer-Specific Retention Policies:

- Develops a flexible policy engine that allows for granular, customer-specific data retention rules.

- Implements cryptographic erasure techniques for secure data deletion at the end of retention periods.

▶ Metadata Management:

- Utilizes graph databases (e.g., Neo4j) for efficient storage and querying of complex metadata relationships.

- Implements automated tagging and classification of data using natural language processing (NLP) and computer vision techniques.

▶ **Compliance and Audit**

▶ Automated Compliance Monitoring:

- Implements continuous compliance monitoring tools (e.g., AWS Config, Azure Policy) to ensure adherence to security and privacy standards.

- Develops custom compliance rules using domain-specific languages (DSLs) for fine-grained control.

▶ Audit Logging and Analysis:

- • Implements a centralized log management system using the ELK stack (Elasticsearch) for real-time log analysis.

- • Utilizes machine learning algorithms for anomaly detection in audit logs, flagging potential security incidents.

▶ Data Lineage and Provenance:

- • Implements a data lineage tracking system to maintain full visibility of data flows and transformations.

▶ **Privacy Impact Assessment (PIA) and Data Protection Impact Assessment (DPIA)**

▶ Automated Risk Assessment:

- • Develops an AI-driven system to continuously assess privacy risks based on data flows and processing activities.

- • Implements quantitative risk modeling using Monte Carlo simulations for precise risk quantification.

▶ Privacy by Design:

- • Integrates privacy considerations into the software development lifecycle using threat modeling techniques

- • Implements privacy-enhancing technologies (PETs) for collaborative data analysis without raw data sharing.

Camera Infrastructure

▶ **New Camera Systems**:

▶ High Definition (HD) Cameras:

- • Resolution: Typically, 720p or 1080p

- • Use cases: General surveillance, facial recognition at close range

- • Advantages: Good balance of quality and bandwidth usage

▶ Ultra-High Definition (UHD) Cameras:

- • Resolution: 4K (3840x2160) or 8K (7680x4320)

- • Use cases: Large area surveillance, detailed facial recognition, license plate reading

- • Advantages: Extremely high detail, ability to digitally zoom without losing quality

▶ Low-Light Cameras:

- Features: High sensitivity sensors, larger apertures, infrared illuminators
- Use cases: Night-time surveillance, dimly lit areas
- Advantages: Clear imagery in low-light conditions without additional lighting

▶ Pan-Tilt-Zoom (PTZ) Cameras:

- Features: Remote directional and zoom control
- Use cases: Active monitoring of large areas, following subjects of interest
- Advantages: Flexibility in coverage, ability to focus on specific areas as needed

▶ Thermal Cameras:

- Features: Detect heat signatures rather than visible light
- Use cases: Perimeter security, fire detection, body temperature screening
- Advantages: Effective in total darkness, through smoke or fog

▶ RTSP (Real-Time Streaming Protocol) Integration:

- Purpose: Enables real-time transmission of video data to AI analysis systems
- Features: Low-latency streaming, compatible with most IP cameras
- Advantages: Allows for immediate processing of video data for real-time alerts and responses

▶ **Integration with Existing Camera Systems**:

▶ **Video Management System (VMS) Integration**:

- API Integration: Many VMS platforms offer APIs that allow AI surveillance software to directly access video streams and metadata
- SDK Integration: Some VMS providers offer Software Development Kits for deeper integration and customization

▶ **Open-Standard Protocols**:

- ONVIF (Open Network Video Interface Forum):
  - Features: Standardized communication protocols for IP-based security products
  - Benefits: Interoperability between different manufacturers' products
  - Profiles: Different profiles for various functionalities (e.g., Profile S for streaming video, Profile G for recording and storage)
- PSIA (Physical Security Interoperability Alliance):
  - Features: Another set of standards for IP-enabled security devices
  - Benefits: Allows for integration of various security systems beyond just vide

- Implementation:
  - Device Discovery: Automatic detection of compatible devices on the network
  - Configuration: Standardized methods for setting up devices and retrieving their capabilities
  - Streaming: Consistent ways to request and receive video streams

- **Cloud-Based Systems**:
  - Hardware Encoders:
    - Convert video signals (often analog) to digital formats suitable for network transmission
    - Types:
      - Standalone encoders: Dedicated devices for video encoding
      - NVR (Network Video Recorder) with encoding capabilities
      - Server-based encoding solutions: Software running on general-purpose hardware
  - Cloud Processing:
    - Advantages:
      - Scalability: Easily increase processing power as needed
      - Accessibility: Access video and AI analysis from anywhere
      - Reduced on-premises hardware requirements

Implementation Considerations:

- Edge Computing: Perform initial processing on-site to reduce bandwidth needs
- Hybrid Approaches: Combine on-premises processing with cloud-based storage and advanced analytics
- Security Measures: Encryption for data in transit and at rest, access controls, compliance with data protection regulations

5. Scalable Deployment

- Built for Large Organizations
- Complete Solution, In-House Team
- Unparalleled Performance and Reliability
- Universal Compatibility with existing infrastructure

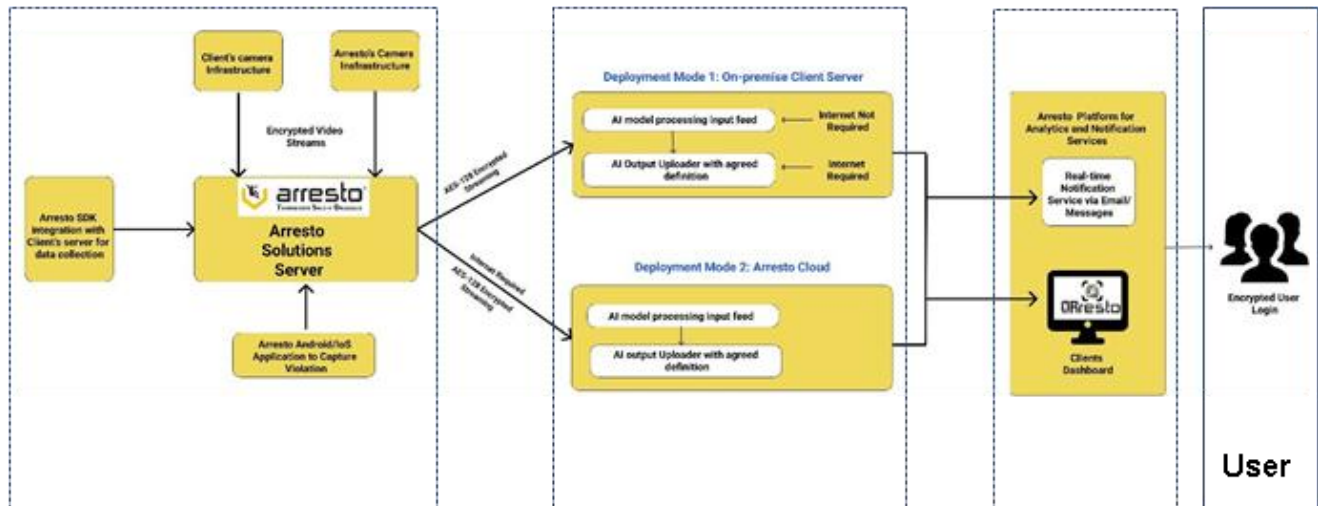**Fig a. AI Solution Architecture**

Arresto Client Server

- **Leverage Existing VMS:** The Arresto client software can seamlessly integrate with your existing Video Management System (VMS). This allows you to utilize your existing camerasand leverage the VMS features you're already familiar with. Arresto provides an SDK (Software Development Kit) to facilitate this integration process.
- **Standalone Camera Deployment with Video Encoders:** If you don't have a VMS or prefer a standalone Arresto system, you can use video encoders. These devices connectdirectly to your existing cameras and convert the analog or digital video signal into a network stream compatible with the Arresto client. Arresto likely provides compatible encoders or supports integration with third-party encoders.
- **Standalone Camera Deployment:** Alternatively, Arresto offers its own camera infrastructure, providing a complete solution if you don't have existing cameras or prefer aunified Arresto system.
- **Mobile App for Capturing Activities:** In addition to these options, Arresto provides a mobile application that allows users to capture video footage directly from their smartphones or tablets. This can be helpful for capturing activities in areas not covered byexisting cameras or for on-the-go surveillance needs.

AI Processing

▶ **Edge Processing**

At-the-edge processing makes the AI processing happen on devices near the cameras before data reaches the central server. This involves tasks like object detection, segmentation and pose-estimation to reduce bandwidth usage and improve real-time responsiveness.

▶ **Arresto Server**

- **Advanced Processing:** The Arresto server performs in-depth analysis on video data using powerful artificial intelligence.
- **Enhanced Security:** This AI technology allows for complex tasks like video analytics, anomaly detection, and even recognizing specific behaviors within the video footage.
- **Pre-Trained and Customized Models:** Arresto might leverage pre-trained AI models for general tasks and offer the option to customize models for your specific needs and surveillance environment.

▶ **Dashboard**
- **Real-Time Visibility**
  ▶ **Live Camera Feeds:** The dashboard offers live views from selected cameras, allowing you to monitor activity in real-time.
  ▶ **On-demand intelligent video:** Access recordings from the past 7, 14, or 28 days with timestamps for identified actions, allowing you to quickly find what you need.
- **Key Safety Metrics:**
  ▶ **Safety Scorecards:** The dashboard displays comprehensive safety scorecards summarizing key metrics like the number of safety incidents, unsafe acts observed, and areas with high-risk activities.
  ▶ **Trend Analysis:** Visualizations showcase trends in safety incidents over time, allowing you to identify areas for improvement and track the effectiveness of implemented safety measures.
- **Actionable Alerts:**
  ▶ **Real-Time Notifications:** The system generates real-time alerts for critical safety violations or engaging in unsafe work practices.
  ▶ **Actionable insights:** Alerts will be accompanied by relevant video clips or snapshots, providing context and facilitating a swift response to potential hazards.
- **Reporting and Analytics:**
  ▶ **Export Data:** The dashboard allow exporting safety data in various formats (e.g., CSV, PDF) for further analysis or generating safety reports.
  ▶ **Advanced Analytics:** Offer advanced analytics tools to identify patterns and correlations within safety data, helping you predict and prevent future incidents.
  ▶ **Custom reporting:** Empower your decision-making with custom reports. Design reports tailored to your needs – daily, weekly, monthly, or quarterly – to gain insights into key metrics at the frequency that best suits your workflow.

6. List of unsafe activities and conditions

50+ Workplace Unsafe Activities and Condition

PPE
- Hard Hat
- Reflective Vest
- Apron
- Cal Suit
- Glasses
- Gloves
- Hard Hat
- Hearing Muff
- Mask
- Sleeve

Housekeeping
- Open-closed doors
- Clean vehicle roads
- Clean pedestrian way
- Unattended object
- Leakage and spill
- Light Controls
- Contact with electricity or discharge area

Hazardous Area
- Crane area: Lift & Hoist
- Crowd Gathering
- Machine-worker restricted area
- Machine area controls
- Vehicle operation zone
- Climbing
- Work at the Edge

Emergency Control
- Fire Detection
- Smoke Detection
- Person Fallen
- Person unconscious
- Line of fire

Behavioral Safety
- Work at height
- Phone Usage
- Maximum worker count
- Minimum worker count
- Stairs banister usage
- Vehicle-Pedestrian Interaction
- Reverse flagman

Machine & Vehicle Control
- Vehicle-Vehicle Interaction
- Speed limit
- Overtaking
- Stray parking
- Wrong Lane driving
- Forklift without PPE
- Vehicle Congestion

Asset Safety
- Time limited area: Anti-theft
- Asset monitoring: Anti-theft
- Perimeter Monitoring: Unauthorized access

Workplace Analytics
- Workforce efficiency
- Time taken to cross a checkpoint
- Hourly traffic density/Analytics
- Vehicle entry/exit count at gates
- ANPR at Checkpoints
- Camera TEMPERING and Health
- Machine/Vehicle count

7. Definitions of the activities:

PPE

The system utilizes deep learning algorithms to analyze real-time video feeds, detecting and identifying the following PPE items on personnel:

1. Coverall Suit (PPE)
2. Safety Glasses (PPE)
3. Protective Gloves (PPE)
4. Hard Hat (PPE)
5. Hearing Protection Muffs (PPE)
6. Face Mask (PPE)
7. High-Visibility Reflective Vest (PPE)
8. Protective Sleeves (PPE)

The AI system is trained to recognize these specific PPE items in various lighting conditions, angles, and partially occluded scenarios. It can:

▶ Detect the presence or absence of each PPE item on individuals
▶ Identify improper wearing of PPE (e.g., hard hat not secured properly)
▶ Track compliance rates over time
▶ Generate real-time alerts for PPE violations
▶ Provide analytics on PPE usage patterns and trends

Housekeeping:

▶ **Open-closed doors:** Unauthorized access or improper closure of doors, potentially compromising security or climate control.
▶ **Clean vehicle roads:** Obstructions, debris, or hazards on vehicle pathways that may impede traffic flow or cause incidents.
▶ **Clean pedestrian way:** Obstacles, trip hazards, or blockages on walkways that could endanger pedestrian safety.
▶ **Unattended object:** Suspicious or potentially dangerous items left in unauthorized areas, posing security risks.
▶ **Leakage and spill:** Detection of liquid or gas leaks, chemical spills, or other substance releases that may pose environmental or safety hazards.
▶ **Light Controls:** Monitoring of lighting conditions to ensure proper illumination for safety and energy efficiency, including detection of non-functional lights.
▶ **Contact with electricity or discharge area:** Identification of unauthorized personnel entering high-voltage areas or potential electrical hazards.

Hazardous Area

- **Crane area:** Lift and Hoist AI algorithms identify designated crane operation areas, monitoring for unauthorized personnel and ensuring safe practices during lifting and hoisting operations.
- **Crowd Gathering:** Static delimitation area The system detects and monitors areas where crowd gathering is restricted, alerting when the number of people in a defined zone exceeds safe limits.
- **Machine-workmen restricted area:** Unsafe area access AI models recognize predefined zones around dangerous machinery, alerting when workmen enter these restricted areas without proper authorization or protective equipment.
- **Machine area controls:** Unsafe area access The system monitors designated control areas of machines, ensuring only authorized personnel interact with critical machine controls and interfaces.
- **Vehicle operation zone:** Unsafe area access AI algorithms detect and track vehicle movement zones, alerting when pedestrians enter areas designated for vehicle traffic, reducing the risk of collisions.
- **Climbing:** Unsafe area access The system identifies instances of unauthorized climbing on structures, scaffolding, or equipment, triggering alerts to prevent fall hazards.
- **Work at the Edge:** Unsafe height AI models detect workmen operating near edges or at heights without proper fall protection, issuing immediate warnings to prevent incidents.

Asset Safety

- **Time limited area:** An AI-powered feature that monitors designated areas during specific time frames, automatically detecting and alerting security personnel to any suspicious activity or presence outside of authorized hours. The system learns normal patterns of movement and behavior, allowing it to identify anomalies with high accuracy.
- **Asset monitoring:** An intelligent tracking system that uses AI to continuously monitor high-value assets. It employs object recognition and behavior analysis to detect unauthorized movement, tampering, or removal of assets. The system can track multiple assets simultaneously and provide real-time alerts if any asset is at risk.
- **Perimeter Monitoring:** An AI-enhanced perimeter security system that uses advanced algorithms to detect and classify potential security breaches along a defined boundary. It can distinguish between humans, vehicles, and animals, reducing false alarms while promptly identifying genuine threats. The system adapts to environmental changes and can be integrated with other security measures for a layered defense approach.

Emergency control

- **Fire Detection**: AI-driven technology designed to identify the presence of flames or heat sources in real-time, enabling rapid response to potential fire hazards before they escalate.
- **Smoke Detection**: An AI-based system that continuously monitors for the presence of smoke, analyzing visual and environmental data to provide early warnings of potential fires.
- **Person Fallen**: An AI-powered solution that detects when a person has fallen, using advanced algorithms to differentiate between normal movements and potentially dangerous falls, triggering alerts for immediate assistance.
- **Person Unconscious**: AI technology capable of recognizing when an individual appears to be unconscious or immobile for an extended period, prompting timely intervention to prevent harm.

- **Line of Fire**: An AI-enhanced detection system that monitors and identifies when a person or object crosses into a hazardous area, such as a restricted zone or an area with active machinery, helping to prevent incidents.

Behavioral Safety

- **Work at Height: Without Harness**: Monitoring and detecting instances where workmen are operating at heights without the use of a safety harness, ensuring compliance with safety protocols.
- **Phone Usage**: Identifying and tracking unauthorized phone usage by workmen in restricted or hazardous areas, aimed at minimizing distractions and enhancing safety.
- **Maximum Workmen Count**: Automatically counting and verifying that the number of workmen in a designated area does not exceed safety limits, ensuring safe and manageable work environments.
- **Minimum Workmen Count**: Monitoring to ensure that the required minimum number of workmen is present in specific tasks or areas, maintaining adequate staffing levels for safe operations.
- **Stairs Bannister Usage**: Detecting whether workmen are using stair bannisters while ascending or descending, promoting safe practices in navigating workspaces.
- **Vehicle-Pedestrian Interaction**: Analyzing and managing interactions between vehicles and pedestrians in work zones to prevent incidents and ensure safe movement through AI-powered monitoring systems.
- **Reverse Flagman**: AI-based detection of the presence and proper use of reverse flagmen during vehicle reversing operations to enhance safety and communication on site.

Machine and vehicle control

- **Vehicle-Vehicle Interaction**: AI-powered analysis of how vehicles interact with each other on the road, focusing on maintaining safe distances, avoiding collisions, and ensuring smooth traffic flow.
- **Speed Limit**: Automated monitoring and enforcement of speed limits using AI, ensuring vehicles adhere to designated speed thresholds to enhance road safety.
- **Overtaking**: AI-driven detection of overtaking maneuvers, evaluating whether they are performed safely and in compliance with traffic regulations.
- **Stray Parking**: Identification and alerting of vehicles parked in unauthorized or non-designated areas, using AI to prevent traffic obstructions and ensure proper parking practices.
- **Wrong Lane Driving**: Real-time detection of vehicles driving in the wrong lane, utilizing AI to quickly identify and address potential hazards.
- **Helmet on Two-Wheeler**: AI-based monitoring of helmet usage by riders on two-wheelers, ensuring compliance with safety regulations and reducing the risk of head injuries.
- **Vehicle Congestion**: AI-powered assessment of traffic density, detecting and predicting areas of vehicle congestion to optimize traffic management and reduce delays

Workplace analytics

- **Vehicle Count**: An AI-driven system that accurately tracks the number of vehicles passing through specific checkpoints, providing real-time data on traffic flow.
- **Time Taken to Cross a Checkpoint**: Utilizes AI algorithms to measure and record the time each vehicle takes to cross a designated checkpoint, helping to identify bottlenecks and optimize traffic management.
- **Hourly Traffic Density/Analytics**: Analyzes traffic patterns on an hourly basis, offering insights into peak traffic times, vehicle types, and density, enabling better planning and resource allocation.
- **Vehicle Entry/Exit Count at Gates**: Monitors and counts vehicles entering and exiting through gates, ensuring

precise tracking and enhancing security at entry and exit points.

- **ANPR at Checkpoints**: Automated Number Plate Recognition (ANPR) technology is used at checkpoints to identify and log vehicle registration details, supporting security and law enforcement efforts.
- **Camera Tampering and Health Monitoring**: AI-powered surveillance ensures that cameras are functioning correctly by detecting tampering attempts and monitoring camera health in real-time, ensuring continuous and reliable operation.
- **Workforce Efficiency**: Evaluates the efficiency of the workforce involved in traffic and security management by analyzing performance metrics and suggesting improvements through AI insights.

8. Benefits & Features

Data Security Our commitment todata security by design and default	**EHS Suite** Preventive Measures for Safety Incidents	**Enterprise readiness** Safety Management Platform Built for Scalability	**Safety** Reduce workplace incidents & increase efficiency

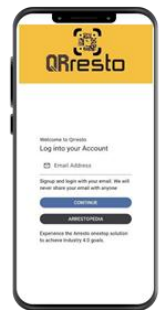|	**Feature**	**Description**
1	**AI-enabled automated unsafe acts and conditions detections**	▸ AI-powered video monitoring ▸ Real-time analysis with 98.6% accuracy ▸ 50-meter range with 1080P resolution
2	**Real-Time Alerts & Notifications**	▸ Real-time alert via WhatsApp & email ▸ Camera & location wise users mapping
3	**Dashboard Features**	▸ Violations details: Image, timestamp, 10 sec video clip, type, resolution status, comment section withfilters ▸ Zoom capability to identify violators ▸ Download violation data in excel/pdf ▸ Analytics charts for visualization ▸ Severity based mapping of violation ▸ Incident and action management ▸ Contractor wise mapping of cameras ▸ Camera management and health status ▸ Notification and user managements

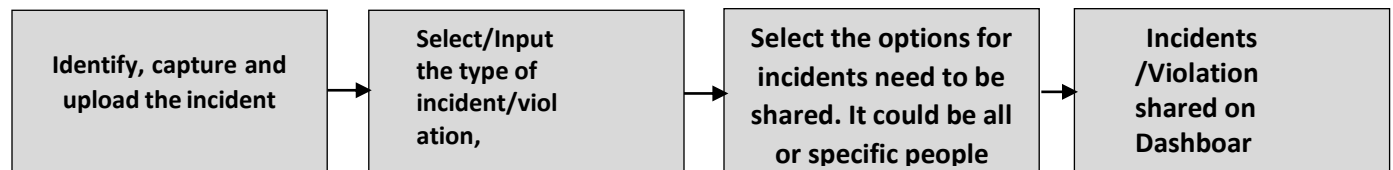| 4	MIS and Reports	▸ Daily/weekly/monthly/quarterly/annual summaryreporting for senior management ▸ Performance report of safety officers
5	Streaming	▸ 24*7 Live streaming ▸ Video recording storage up to 7/12/28 days
6	Industrial integration	▸ APIs for integration with existing software to utilizedata ▸ On-site real-time audio/visual alerts systems

9. Safety Incident Sharing Mobile Application

Arresto allows quick and easy reporting of violations even outside camera range. The user-friendly interface allows the employees to report safety violations using their smartphones or tablets.

Reported incidents and violations are instantlyshared with relevant stakeholders. It streamlines communication and ensures everyone has the information they need. Additionally, Arresto generates customized reports for management, providing valuable insights for improving safety protocols

Steps to Share Incidents

Identify, capture and upload the incident	→	Select/Input the type of incident/violation,	→	Select the options for incidents need to be shared. It could be all or specific people	→	Incidents /Violation shared on Dashboar

Benefits:

▸ **Effortless Reporting:** Simple interface for capturing safety violations on the go.
▸ **Increased Visibility:** Report incidents even outside camera range.
▸ **Improved Collaboration:** Real-time sharing of information withstakeholders.
▸ **Faster Action:** Reduce turnaround time for addressing safety concerns.
▸ **Data-Driven Decisions:** Generate customized reports for informeddecision-making.

10.New unsafe acts and condition modeling

The new module for safety systems allows the addition of new unsafe activities in the AI. Arresto's innovative "New Activity Modeling" addresses this challenge. New unsafe acts and conditions may be added easily based on feasibility.

Step No.	Description	Timeline	Stake Holder
1	Identity the feasibility of activityor condition that needs to be monitor	4 Days	Arresto
2	Data Collection	10-14 Days	Client & Arresto
3	Transforming data into structured format with labels	4 Days	Arresto
4	Training Model	4 Days	Arresto
5	Deployment on Cloud or edge device	2 Day	Arresto

11.Return on Investment

90%	80%	50x	80%
Reduction in at-riskbehavior among workforce	Reduction in time-to-action forsafety officers	More nonconformitie sidentified by AI then manual observation	Cost reduction todetect hazard at workplace

Improved Security and Loss Prevention:

▶ AI-powered features like object recognition, anomaly detection, and real-time alertscan help deter theft, vandalism, and other security incidents. This can lead to cost savings in terms of stolen goods, property damage, and insurance claims.

Enhanced Operational Efficiency:

▶ Features like people counting and traffic pattern analysis can help optimize resource allocation and improve workflow management. For example, you might beable to optimize staffing levels based on real-time customer traffic in a retail store.

Increased Safety:

▶ AI can be used to detect unsafe work practices or identify potential hazards in real-time, preventing accidents and injuries. This can lead to reduced workers'compensation claims and improved overall safety culture.

12. Investment

▶ Artificial Intelligence is successful when its deployment coverage is widespread across the organisation. The challenge is high costs. The top management plays a crucial role in optimising the investment by mass roll out and centralised control of the AI program.
▶ The optimum amortisation of an AI program across a large organisation would be in excess of 200 cameras, which would result into huge savings and making the AI project practical and affordable.

13. Taxes

18% GST Extra

14. Deployment Plan

S No.	Activity	Week																
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	Understanding Requirement of Hazard Monitoring AI Models	█																
2	Configuring AI module in Arresto Connect+ App		█	█	█													
3	Uploading AI logic in App of all the models agreed					█	█	█	█									
4	Installation of Camera									█	█	█	█					
6	Setup of Camera Feed and Configuring AI Logic													█	█	█	█	█

Arresto Solutions Pvt. Ltd. | A-48, Sector-4, Noida - 201301, Uttar Pradesh

15.Safe working policy of Arresto team at client site.

Arresto team follows client's safety regulations during the process of Installation of cameras at site.

Thanking You,

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Authorised Signatory

 Mohammad

CEO-Arresto Solutions Pvt Ltd