



1. EXECUTIVE SUMMARY

Across the industrial and agricultural sectors worldwide, safety systems remain largely reactive rather than preventive.

Factories, processing plants, and agritech facilities often depend on manual inspections, limited automation, and static control systems to manage complex environments.

This reactive approach leaves workers, machinery, and production vulnerable to avoidable **incidents** such as equipment breakdowns, overheating, gas leaks, fatigue-related errors, or overcrowding in hazardous zones.

To address these challenges, our project introduces Eyeconic, an **AI-Driven Safety Digital Twin**, a cutting-edge solution that transforms how industries manage risk and safety.

Eyeconic creates a virtual replica of a facility that continuously mirrors real conditions through data from IoT sensors, smart wearables, and cameras.

The digital twin doesn't just visualize; it analyzes and predicts, using artificial intelligence to identify unsafe patterns, simulate potential anomalies, and recommend preventive actions in real time.

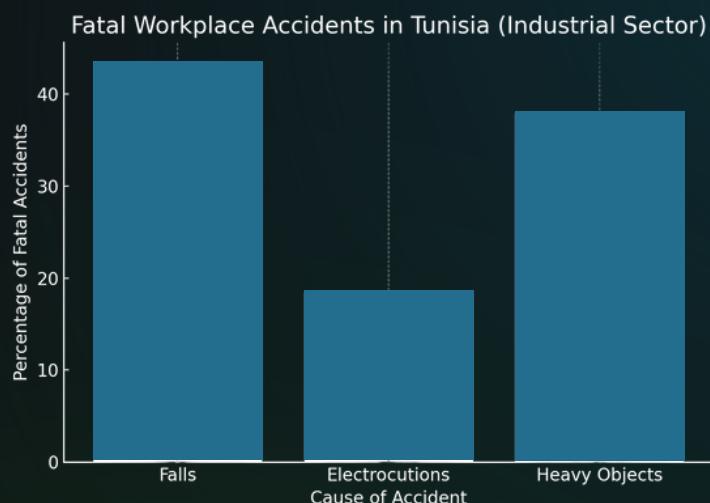
By uniting **AI, IoT, and simulation technologies**, **Eyeconic** aims to establish a "Predict and Prevent" safety paradigm, helping organizations worldwide reduce accidents, anticipate failures, and optimize operations sustainably.

The system's modular, low-cost design makes it scalable across multiple industries, from manufacturing and logistics to energy and agriculture, accelerating the transition toward **Industry 4.0 and Safety 5.0 ecosystems**.



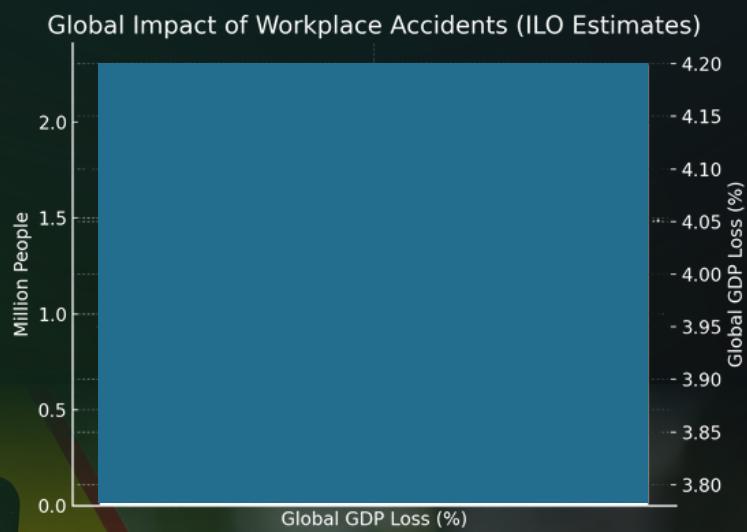
2. PROBLEM STATEMENT

Every second counts in a factory; one overheated motor or distracted worker can spark a costly, even dangerous incident. Yet safety in most industrial environments remains reactive, not proactive. Manual checks and outdated processes leave workers and machines exposed, with little real-time insight into what's happening, whether a machine is failing, a worker is too close to danger, or fatigue is setting in.



In Tunisia, the National Health Insurance Fund (CNAM) recorded **345 fatal workplace accidents** between **2019 and 2021**, mainly caused by falls, electrocutions, and heavy objects. The industrial sector alone represents **12.6 %** of all fatal cases, with falls (**43.5 %**) and electrocution (**18.5 %**) as the top causes, underscoring persistent safety gaps in industrial environments.

Globally, the International Labour Organization (ILO) estimates that **2.3 million** people die each year from work-related causes, leading to a loss of about **4 %** of global GDP. These figures highlight the immense human and economic cost of unsafe workplaces and the urgent need for stronger safety measures worldwide.



Inside many factories, machines still fail without warning, workers unknowingly enter risky areas, and safety officers can only step in after something goes wrong. It's clear that the system needs to evolve, toward one that can see problems coming before they happen.



3. STUDY OF EXISTENCE

Popular industrial safety and automation solutions in Tunisia, such as ioWaves, 4InA Technologie, Arcana Soft (Arckium), DatiPlus, 3S, and Enova Robotics, are steadily helping factories modernize and transition toward smarter operations.

Advantages



- They use IoT sensors and AI tools to monitor equipment performance and improve operational efficiency.
- Predictive maintenance functions help reduce machine downtime and optimize production schedules.
- Smart cameras and gas detectors enhance workplace visibility and improve overall safety conditions.
- They provide data dashboards that simplify analysis, reporting, and maintenance planning.

- Many solutions still operate as separate systems, with limited integration between sensors, cameras, and software.
- They tend to react to issues after they begin, rather than forecasting potential risks.
- Their high setup and integration costs make adoption difficult for small and mid-sized factories.
- Most systems require external expertise to configure, update, and manage effectively.

Disadvantages





4. PRESENTING SOLUTION

A. OVERVIEW

Imagine a factory that **can sense danger before it strikes**, one that notices a machine starting to vibrate abnormally, a group of workers crowding near a hazardous zone, or a technician showing early signs of fatigue. That's the vision behind Eyeconic, an AI-driven digital twin designed to make factories not just smarter, but safer.

EYECONIC acts as a virtual replica of the factory, continuously fed with live data from IoT sensors, cameras, and smart wearables. It doesn't just display what's happening, it understands and predicts. Using AI models, EYECONIC analyzes vibration, temperature, motion, and environmental patterns to detect risks before they escalate. When it spots warning signs, it can trigger instant alerts, slow down machines, or recommend preventive maintenance to stop accidents before they occur.



Beyond monitoring, EYECONIC becomes a smart assistant for safety managers, learning from daily operations to spot recurring risks and recommend preventive actions. It shifts factories from reacting to incidents to anticipating and avoiding them, creating a safer, more proactive workplace.



B. CORE FEATURES

Eyeconic is an intelligent safety ecosystem that continuously mirrors, analyzes, and predicts factory operations.

It combines IoT sensing, AI analytics, and digital simulation to prevent accidents before they happen

- **Real-Time Factory Mirroring**

A live 2D/3D visualization of the factory environment.

Displays the current status of machines, workers, and environmental conditions.

Automatically updates based on sensor and camera data (temperature, vibration, gas, motion, location).

Benefit: Gives safety teams instant visibility into what's happening on the shop floor.

- **Machine Health Prediction**

IoT sensors monitor vibration, current, and temperature.

AI models detect abnormal patterns that may indicate mechanical wear, fire risk, or overheating.

Sends early warnings to maintenance teams before breakdowns occur.

Benefit: Prevents costly downtime and enhances operational reliability.

- **Worker Safety & Proximity Analysis**

Smart tags or camera vision detect worker positions in real time.

The system identifies dangerous clustering near hazardous zones (e.g., high voltage, moving parts).

Sends visual or audible alerts to supervisors or workers instantly.

Benefit: Reduces accidents caused by overcrowding or human error.



B. CORE FEATURES

- **Fatigue & Health Monitoring**

Smart wearables track metrics like heart rate, step count, and motion.

AI detects early signs of fatigue or stress and recommends short breaks or shift adjustments.

Benefit: Minimizes fatigue-related injuries and improves worker well-being.

- **Predictive Anomaly Simulation**

The digital twin runs simulations of possible anomalies (machine overheating, gas leak, spill).

Predicts how incidents might spread and suggests containment or evacuation actions.

Benefit: Enables proactive decision-making and preparedness.

- **Intelligent Safety Alerts & Dashboard**

Centralized dashboard (desktop/web) aggregates all safety alerts and sensor readings.

Uses color-coded indicators (green = safe, yellow = warning, red = danger).

Logs all incidents and predictions for later review and analytics.

Benefit: Simplifies safety supervision and creates a digital audit trail.



C. PRELIMINARY BUDGET

Human resources

Developers

18 000 TND / Year



Technology & Development

DevelopCloud Hosting (AWS/Azure/OVH), Security, Backup Servers

12 000TND / Year



Marketing & outreach

6 000 TND / Year



Testing & optimisation

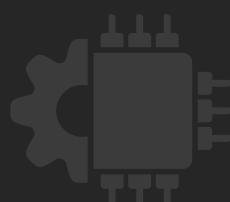
7 500 TND / (each deployment phase)



Hardware

IoT devices

9 000 TND



Total Expenses

52 500 TND

Initial + Operational
(1 year)





D. SWOT ANALYSIS



STRENGTHS

Innovative Predictive Approach:

Unlike existing Tunisian safety solutions, Eyeconic goes beyond monitoring – it predicts incidents before they happen, shifting from reactive to preventive safety.

Comprehensive Integration:

Combines IoT sensors, AI analytics, and digital simulation in one connected ecosystem, overcoming the fragmentation seen in other local solutions.

Real-Time Visibility:

Live 2D/3D visualization of machines and workers provides instant situational awareness – a first for many local factories.

Scalable & Modular Design:

Built using low-cost, open-source hardware (ESP32, Raspberry Pi) and software (Python, TensorFlow, Node-RED, Unity), making it affordable for both SMEs and large factories.

WEAKNESSES

Prototype Maturity:

Still at an early stage, requires further development, industrial testing, and validation under real factory conditions.

Infrastructure Dependence:

Needs reliable connectivity and IoT infrastructure, which can be inconsistent in some industrial zones.

Maintenance & Calibration:

Regular sensor calibration and system updates may require technical skills not yet common in smaller factories.





D. SWOT ANALYSIS

OPPORTUNITIES

Funding & Partnerships:

Eligible for local innovation funds (Startup Tunisia, ANPR grants) and global programs (UNIDO, GIZ, IEEE Innovation initiatives).

Data-Driven Industrial Intelligence:

With continuous data collection, Eyeconic can evolve into a predictive analytics platform, offering insights for insurance pricing, maintenance scheduling, and risk benchmarking, opening new revenue models.

International Funding & Acceleration:

Eligible for support from innovation programs like GIZ's Digital Transformation Centers, UNIDO's Industry 4.0 initiatives, World Bank SME Tech Funds, and EU Horizon Europe projects focused on smart manufacturing.

THREATS

Market Resistance to New Tech:

Many Tunisian factories still operate under low digital maturity and may resist adoption due to cost or lack of trust in AI.

Skill Gap:

Shortage of local experts in AI maintenance, IoT networking, and cybersecurity could slow large-scale deployment.

Economic Instability:

Budget constraints in the industrial sector could delay investment in innovative safety solutions.





E. PESTEL

Political

- Governments promote Industry 4.0, digital safety, and smart agriculture initiatives.
- Supportive policies and innovation grants encourage adoption of AI-based safety systems.



- Reduces costly downtime and accidents.
- Affordable, open-source design suits SMEs and developing markets.
- Expanding global market for predictive maintenance and digital twins.

Economic



Sociological

- Improves worker and animal welfare.
- Builds a preventive safety culture and community trust.
- Enhances productivity and morale.



- Combines IoT, AI, and digital twins for predictive safety.
- Uses open-source, low-cost hardware and software.
- Scalable across industrial and agritech sectors.

Technological



Environmental

- Supports energy efficiency and emission reduction.
- Monitors environmental factors for sustainability.
- Contributes to SDG goals on climate and responsible production.



- Aligns with international safety standards (ISO 45001) and data protection laws.
- Simplifies compliance and documentation for audits.
- Encourages proactive occupational safety reporting.

Legal

