

Construction Hazards and Risks Control

Lecture Title: – Advanced Risk Control Strategies: Leveraging Technology for Hazard Detection and Management

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**Undergraduate Diploma in
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The integration of digital technologies into Health, Safety, and Environmental (HSE) management has revolutionized industrial operations, offering new opportunities for improving safety outcomes and mitigating risks.



- PPE (Personal Protective Equipment) detection Using Deep learning-
CNN



IOT

- **The Internet of Things (IoT) describes a vast network where everyday objects – from household appliances to industrial machinery – are interconnected.** These objects are equipped with sensors, software, and connectivity, allowing them to gather and share data.
- This interconnectedness enables remote monitoring and control of devices, bridging the gap between the physical and digital worlds. By leveraging IoT, businesses and individuals can enhance efficiency, improve accuracy, and unlock new economic opportunities through data-driven insights and automated processes.



What is IOT in Workplace Safety

- **IoT in workplace safety leverages connected devices and sensors to create a safer work environment.** This involves using technology like wearable devices for worker safety tracking, smart systems for monitoring environmental conditions (temperature, humidity, air quality), and predictive maintenance systems to anticipate equipment failures.
- By collecting and analysing real-time data, IoT empowers proactive safety measures. This allows for the identification and mitigation of potential hazards, ultimately reducing the risk of workplace accidents and improving overall safety for employees.



What are the Ways in Which IoT is Leading to Safer Workplaces?

- **IoT empowers workplace safety through a range of technologies.** These include real-time monitoring of work environments
- Predictive maintenance of equipment
- Immediate safety alerts
- Remote access control
- Worker location tracking
- Efficient inventory management
- Wearable safety devices
- Vehicle tracking,
- Comprehensive safety data analysis, and continuous data collection.



Real- Time Monitoring

- **IoT devices enhance workplace safety by continuously monitoring critical conditions like temperature and air quality.** This real-time data empowers workers with immediate alerts about potential hazards, minimizing the risk of accidents and health issues.
- For example, wearable communication systems can provide workers with crucial safety updates and alerts about out-of-tolerance conditions directly within their field of vision, ensuring prompt response to potential dangers.



- [\(60\) XEVOLVEX Inc. Corporate Presentation Fatigue Service - YouTube](#)



Latest technology in a HW/SW system. Artificial Intelligence (AI) + Human Monitoring.

What is it?

- ◆ The implementation of a state-of-the-art Hardware + Software + Wireless Communications System incorporating Artificial Intelligence (AI) + 24x7 Human Monitoring. The Service continuously monitors and reports fatigue, distraction, or anomalous events of your drivers in vehicles or machinery, in real time.

What is it for?

- ◆ To identify real-time signs of fatigue, distraction and prevent accidents, collisions, risky behavior. These events immediately alert the Client and the Driver in the cabin. Events caused by fatigue, distractions, and human anomalies during the operation of vehicles and/or machinery.



How does it do it?

- ✓ In cabin DMS system: Artificial Intelligence analyzes in real-time actions and facial gestures preceding the threshold of fatigue and/or distraction.
- ✓ Frontal ADAS system (optional): It detects and alerts the operator in real-time of dangerous approaches to objects or person in front of the vehicle based on the ongoing speed.
- ✓ Vehicular in-cabin alerts: Immediate real time alerting the operator/driver for their reaction. Either audible (real voice messages via speaker) or haptic (vibrating seat cover) alerts.
- ✓ Alerts are instantly sent and logged in the Management Software Platform: via image frames and video (stored in local memory for subsequent analysis and/or real-time transmission). Analyzed by our 24x7 Monitoring Center for immediate customer contact and attention. ALL IN REAL TIME.



...How does it do it?

- ✓ At XEVOLVEX, we have perfected the synchronization of AI + Human Monitoring Systems.
 - ✓ **Result:** Almost 100% precision for real-time incident's detections (minimal false positives).
- ✓ Corporate whitepapers and research ^(*), support the efficacy of our System compared to other technologies:
 - ✓ **The BEST** Compared to other technologies on the market: visors (smartcap, etc.), sleep wristbands, ECG monitoring, activity detectors, sound.
 - ✓ **The MOST EFFICIENT:** Not only does it detect fatigue, it also prevents collisions and distraction incidents, cell phone use, smoking, drinking, seat belt use, facial ID. Events that are NOT captured by other systems..

(*) *Fatigue and Distraction detection: A review of commercially available devices to detect fatigue and distraction in drivers. R-2020-6.*



What else?

- ◇ **We provide real-time fatigue and distraction alert service.** Our Monitoring Center operates 24x7 and is composed of highly specialized, experienced personnel.
- ◇ **Real-time Monitoring Center:** Alerts your staff to priority fatigue alerts. The client takes immediate action.
- ◇ **We have perfected the System by customizing it for various industries.** From the correct installation of cameras for greater efficiency, to calibrating the analysis electronics according to your operations, minimizing false alerts and avoiding unnecessarily disturbing your Drivers.
- ◇ **Optionally:**
 - ◇ In-cabin cameras, side cameras, rear cameras, 360-degree PTZ remote control cameras.
 - ◇ In-cabin display screen for the operator.



What else?

- ◆ We also provide (included at no additional cost) Fleet management's Reports, Statistics, Alerts, and telemetric records of historical data via built in GNSS and accelerometers:
 - ◆ Speed alerts and control of violations.
 - ◆ Engine and conduction hours.
 - ◆ Stops (required, unscheduled), idling.
 - ◆ Operator, driver identification: Facial ID recognition or electronic ID (Key).
 - ◆ Vehicle's or machinery's computer diagnostics and information (optional via CANBUS compatibility): Fuel consumption and level controls.
 - ◆ "Black Box" type records of every event for reconstruction: speeds, G-forces, driver at the wheel, front videos, cabin interior.
- ◆ Suitable for Operators of Tractors, Haul trucks, Terminal Trucks (TTs), Gantry Cranes, Reach Stackers, Trucks, Heavy Machinery, Passenger Buses, Machinery for Ports, Mines, Warehouses.



...anything else?

- ◆ Perhaps the most noteworthy aspect:

How to consider the HUMAN FACTOR in the fatigue/distraction problem: your Operators?

- ◆ **Optionally, we provide a specialized Service with Occupational experts in the science of Fatigue and health.**
 - ◆ By using modern technological software tools, we measure and establish a Baseline of health: physiological and psychological for your Operators and Drivers.
 - ◆ From there, a training program and periodic virtual advice is established (Guided via an easily accessible software app on smartphones), personalized for each individual. Especially the emotional aspect with the help of meditation and Mindful Thinking techniques.
 - ◆ The purpose is to correct bad health and behavior habits. The aim: to improve the health of your Collaborators and increase productivity in a harmonious environment.



Predictive Maintenance

- IoT devices enable predictive maintenance by continuously monitoring equipment and machinery for signs of wear and tear. This allows for timely repairs before failures occur, preventing costly downtime and potential safety hazards. For instance, IoT sensors can detect early signs of issues like slow gas leaks or overheating, enabling proactive intervention



Safety Alerts

- IoT devices can be programmed to trigger alerts when critical safety thresholds are exceeded. For instance, if temperatures surpass safe limits, immediate notifications are sent to both workers and management



Remote Access Control

- IoT devices can be utilized to control access to hazardous areas, restricting entry to authorized personnel only. This crucial safety measure helps prevent accidents arising from unauthorized entry.
- Furthermore, the capability to remotely monitor containers and other equipment eliminates the need for workers to conduct physical inspections in potentially dangerous environments, significantly enhancing their safety.



Location Tracking

- IoT devices enable real-time worker tracking, particularly in hazardous or remote locations. This enhances worker safety by facilitating rapid response in emergency situations.



Inventory Management

- **IoT devices streamline inventory management of safety equipment and supplies.** By continuously monitoring stock levels, they ensure workers always have access to the necessary safety gear.
- This not only simplifies inventory tracking but also enhances efficiency. Accurate stock levels are maintained, minimizing the risk of shortages or overstocking.



Wearable Devices

- Wearable devices, such as smartwatches and fitness trackers, can monitor worker health in real-time, alerting individuals to potential health risks like fatigue or excessive stress. This proactive approach helps prevent accidents and illnesses, ultimately reducing healthcare costs associated with workplace injuries



Vehicle Tracking

- IoT technology enhances vehicle and driver safety, particularly in hazardous environments. By tracking vehicle location, monitoring driver behaviour, and providing real-time alerts, IoT systems help prevent accidents and safeguard both drivers and passengers.
- Furthermore, in warehouse and storage settings, laser scanners play a crucial role in improving safety. These systems monitor equipment and vehicle navigation, preventing collisions and ensuring the well-being of all personnel within the facility.



Process Automation

- By automating processes with IoT devices, we can significantly reduce the risk of human error, a leading cause of workplace accidents. This increased automation leads to safer and more reliable operations.



Safety Data Analysis

- By collecting extensive data on workplace conditions, IoT devices provide valuable insights into safety trends and potential hazards. This data-driven approach enables organizations to develop proactive safety strategies and significantly reduce the occurrence of accidents



Autonomous Machines on Construction Sites

- Technology has influenced nearly every modern industry by improving efficiency, safety, and cost savings. While some industries have embraced new technology from the moment it is released, the construction industry has historically been slow to onboard automated solutions
- Autonomous machines are a prime example of construction automation. These self-driving vehicles transport materials and haul heavy loads without human operators. Equipped with sensors and robotics, forklifts, diggers, and trucks operate independently. By defining routes, integrating GPS, and programming machine movements, workers can remotely control equipment, enhancing efficiency and safety



Drones to Survey Working Areas



Drones to Survey Working Areas

- **Drones are transforming construction safety through automated site inspections.** By eliminating the need for manual supervision in potentially hazardous areas, drones equipped with advanced sensors can autonomously scan the worksite for potential dangers such as unstable structures, exposed wires, and unsafe excavations.
- These drones transmit real-time data and imagery to a central control system, enabling rapid identification and response to safety concerns. This automated approach not only enhances worker safety but also improves overall site efficiency by minimizing delays caused by unforeseen hazards



Robotics in Construction

Using robotics in construction doesn't mean that humans are removed from the process.



Virtual Reality During Project Planning and Training

- By creating immersive digital replicas of projects, VR allows builders to virtually walk through structures before a single brick is laid.
- This technology, utilizing highly accurate 3D scans, minimizes human error and enables detailed planning for construction, maintenance, and even potential future repairs. For example, builders can virtually navigate through complex pipe systems to assess accessibility for maintenance.



Challenges with the IoT- Based Safety Monitoring System

- While IoT-based safety monitoring systems offer significant potential for enhancing construction worker safety, several challenges must be addressed.
- Firstly, effective implementation hinges on a solid understanding of IoT technology. The scarcity of skilled IoT professionals can pose a significant hurdle.
- Secondly, the initial investment in an IoT safety monitoring system can be substantial, potentially exceeding the budgets of many construction companies.
- Finally, perhaps the most critical challenge is cybersecurity. The interconnected nature of IoT devices creates a vast attack surface, making them vulnerable to cyber threats.



Aircraft incident

- https://assets.publishing.service.gov.uk/media/5422faa7e5274a131400078d/1-1992_G-BJRT.pdf

