Architecture for Scalable, Self-*, human-centric, Intelligent, Secure, and Tactile next generation IoT

assist-iot

ASSIST-IoT Architecture in OSH Management – E-Tool for the Construction Sector

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OSH challenges at the construction site

- Dynamic nature and uniqueness of each construction site as well as involvement of subcontractors

A need for new measures to support construction companies in ensuring safe conditions at work

Fatal and non-fatal accidents at work by NACE section, EU, 2020
Next Generation Internet of Things

ASSIST-IoT main goal is to develop a **new architectural approach** to future IoT.

Address **scalability and flexibility** of data processing and analytics.

Address the needs of smart factories, logistics, constructions and automotive industries.

Allow **multiple streams of human and environment** collected contextual data, to benefit multiple AI-infused applications.

Transform existing IoT-based solutions into **smarter, more secure, trustable, and efficient environments**.
Smart Safety of Workers Pilot – BS1

The pilot led by the Central Institute for Labour Protection – National Research Institute in collaboration with Mostostal Warszawa SA includes 3 business scenarios

- **BS 1: Occupation safety and health monitoring**

  Role of ASSIST-IoT
  - Prevention from an unauthorised access to restricted construction zones
  - Real-time monitoring of working conditions
  - Immediate information about the location of accident and the need for medical assistance

Photo by MOSTOSTAL Warszawa SA

Construction site of the Psychology Department of the University of Warsaw
Smart Safety of Workers Pilot – BS1

WORKERS’ HEALTH AND SAFETY MONITORING
Smart Safety of Workers Pilot – BS2

• **BS 2: Fall-related incident identification**

Role of ASSIST-IoT

• To inform the OSH manager about any incident (fall on a ground or fall from a height) to respond and investigate

• To provide urgent help if a construction worker is suspended from the fall arrest equipment
FALL-RELATED INCIDENT IDENTIFICATION
Smart Safety of Workers Pilot – BS3

- **BS 3: Health and safety inspection support**

**Role of ASSIST- IoT**
- To deliver health and safety inspection support
- Worker identification for the (semi)-automated OSH reporting
- Effective permission checking
- Fast, safe and efficient evacuation routes
- Current information on the number of evacuated employees
Smart Safety of Workers Pilot – BS3

HEALTH AND SAFETY INSPECTION SUPPORT
Ultraviolet (UV) radiation is a form of non-ionizing radiation that is emitted by the sun and artificial sources. Exposure to UV offers advantages (7-dehydrocholesterol in the skin absorbs UV B radiation and is converted into vitamin D3), but it can also pose health hazards.
Validation example - UV exposure monitoring

**Mission:**  
To safeguard workers’ health, it's crucial to prioritize protective measures against UV radiation, especially for those in high-risk occupations.

- Relatively long periods between successive and collective risk assessment  
- Real-time and personalised risk assessment

**Successful Integration:**  
Our UV risk assessment algorithm was seamlessly integrated with the ASSIST-IoT system, ensuring smooth operations.

**Validation:**  
The approach was tested on a construction site, providing real-time UV exposure data for construction workers and OSH managers.

Photo by Almada Studio: https://www.pexels.com/photo/person-showing-left-eye-609549/
UV Risk Assessment Algorithm

- The UV risk assessment scheme is based on the elements of the EN 14255-3 standard
- The process is semi-quantitative, combining qualitative observations with quantitative data
- The UV Index (IUV) is the initial baseline exposure value

<table>
<thead>
<tr>
<th>Duration of exposure</th>
<th>from the location tracking system</th>
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<tbody>
<tr>
<td>Worker's location</td>
<td>from the weather station</td>
</tr>
<tr>
<td>UV Index measurements</td>
<td>objective data</td>
</tr>
<tr>
<td>Season</td>
<td></td>
</tr>
<tr>
<td>Date of exposure, corresponding to the PPE assigned to the worker</td>
<td></td>
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</tbody>
</table>
UV Exposure Estimation

\[ f = v \left( \sum_{i=1}^{n} I_{UV_i} \cdot \sum_{j=1}^{m} L_j \right) \cdot \text{PPE} \]

Value of \( I_{UV_i} \) measured by the weather station at a given time.

\( L_j = 0 \), when location tracking shows that the worker stays inside at a given time.

\( L_j = 1 \), when location tracking shows that the worker stays outside at a given time.

\( \text{PPE} = 1 \), when workers has partially unprotected torso, neck, and legs (calendar summer).

\( \text{PPE} = 0.5 \), when workers has protected torso but exposed arms and legs (calendar spring/fall).

\( \text{PPE} = 0.2 \), when workers has only hands and face exposed (calendar summer).
Tests at the Construction Site

UVI onset = 4

UVI - real vs UVI - simulated over Time

- **Warning**
- **Danger**

- $f = 5$
- $f = 3$
Conclusions and future prospects

- Issues identified by the end-users
- Challenging business scenarios addressing identified needs
- Tight cooperation of 15 partners guaranteeing full coverage of the required competences
- Validation in real-life conditions at the construction site

The success of this integration opens doors for further development and enhancements, promising even more comprehensive safety measures in the future
EU-OSHA’s E-tools seminar on Occupational risk assessment and prevention in the Construction and other Outdoor workplaces 4-5 October 2023

Thank You Questions?

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