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The Impact of IoT Implementation on the Effectiveness of the Occupational Health and Safety Management System in Automotive Companies

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ABSTRACT
This digital transformation fundamentally reshapes how organizations manage operational processes, including occupational safety management. This study aims to empirically examine the effect of Internet of Things (IoT) implementation on the effectiveness of the Occupational Health and Safety Management System (OHSMS) in automotive companies. A total of 120 respondents were involved, including OSH officers, production supervisors, technicians, and production line operators. The independent variable in this study is the level of utilization of sensor-based technology, smart devices, and digital monitoring systems to support occupational safety risk control. The findings indicate that IoT implementation has a positive and significant effect on OHSMS effectiveness, with a regression coefficient of 0.703 and coefficient of determination (R^2) of 0.551. The results highlight the strategic role of IoT in enhancing proactive and data-driven safety management.

INTRODUCTION

Occupational Safety and Health (OHS) is a fundamental component of modern industrial operations, particularly in high-risk manufacturing sectors such as the automotive industry. Effective OHS implementation promotes operational sustainability by reducing accidents, increasing productivity, and strengthening the company's reputation among stakeholders and regulators. The risk of workplace accidents contributes to decreased efficiency and the potential for significant economic losses, making robust OHS risk management a strategic necessity for the manufacturing industry. Previous research has shown that a systematic OHS approach can reduce accident rates and improve compliance with safety procedures (Yusuf et al., 2025).

The automotive industry presents complex Occupational Health and Safety (OHS) risks due to the high level of human-machine interaction and the use of sophisticated automated equipment. Automotive production lines often involve repetitive operations, the use of industrial robots, and high time pressure on the production floor. These factors increase the potential for hazards such as machine accidents, musculoskeletal disorders, and exposure to less-than-ideal environmental conditions. International research has noted that the automotive sector faces significant musculoskeletal and ergonomic risks, particularly in assembly areas (Zahra et al., 2025).

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Conventional OHS management systems are generally reactive and rely on periodic manual inspections, which often fail to detect risks quickly and accurately before incidents occur. Delays in reporting and limitations in data processing can hinder rapid response to potential hazards, thus limiting the system's effectiveness. In many cases, safety data is collected only partially and analyzed after the incident, thus under-utilizing proactive prevention efforts (Wahidin, 2025).

With the advent of the digital era and the Industry 4.0 paradigm, the automotive industry is undergoing significant transformation through the integration of digital technology and automation. This digital revolution is changing the way companies manage operations, including aspects of occupational safety, which can now be monitored and analyzed in real-time through intelligent technology. This new paradigm supports data-driven safety management, rather than relying solely on periodic inspections or audits (Mahrani et al., 2025).

The Internet of Things (IoT) revolutionizes occupational safety management with smart sensors that monitor environmental conditions and equipment in real-time in the manufacturing industry, including automotive (IoT For All, 2024; Maintworld, 2025). In the automotive sector, IoT supports risk prediction through big data analysis, reducing downtime and improving regulatory safety compliance (Prithiviraj, 2025; Telit, 2025). This is crucial because the automotive industry faces high risks from heavy machinery and fast production processes (Eurogip, 2024).

The Internet of Things (IoT) is a pillar of digital technology that holds significant potential for transforming industrial safety and health (OHS). In general, IoT refers to a network of physical devices equipped with sensors and data communication capabilities to continuously collect, monitor, and analyze operational parameters. In an industrial context, IoT enables real-time monitoring of work environment conditions, worker health, and machine status with high accuracy (Kumbhakarna et al., 2025).

The use of IoT devices, including sensors, wearables, and digital monitoring systems, offers significant opportunities to improve the effectiveness of Occupational Health and Safety (OHS) management. IoT sensors can detect hazardous environmental conditions such as toxic gases, excessive heat, or abnormal worker health parameters, then transmit the data directly to a control center for processing and action. This allows for faster and more responsive interventions to emerging risks (Mayori et al., 2025).

IoT implementation to improve the effectiveness of OHS management systems includes real-time environmental monitoring, early warning systems, and support for accurate, data-driven decision-making. With real-time data, management can respond to potential hazards before they become detrimental incidents. This contrasts with traditional approaches, which often identify risks too late (Deshvena & Kulkarni, 2024).

In practical applications, IoT can improve compliance with safety procedures, for example by tracking the use of wearables like smart helmets or devices that monitor exposure to the workplace. Case studies and system prototypes have shown that the use of IoT sensors can provide more accurate and faster information than manual methods (Budiono et al., 2025).

The relevance of IoT in OHS management systems in automotive companies is further strengthened by the trend of smart manufacturing technology (Manufacturing 4.0), where digital elements such as cyber-physical systems (CPS) and IoT are integrated into production lines. A case study in the automotive sector revealed that the implementation of Industry 4.0 digital systems such

as predictive maintenance and real-time monitoring contributed to reducing occupational risks through responsive and adaptive automated mechanisms (Nioata et al., 2025).

IoT integration also has the potential to improve worker safety behavior through instant feedback and easier-to-understand data visualization. Information regarding environmental risks or health monitoring can be presented directly to workers and management, thereby strengthening a safety culture within the organization (Deshvena & Kulkarni, 2024).

However, implementing IoT into OHS systems is not without challenges. Digital infrastructure readiness, limited workforce technology literacy, and integration with existing management systems are key obstacles that need to be addressed. These challenges include the need for training, infrastructure investment, and interoperability between legacy and new systems (Wahidin, 2025).

Furthermore, cybersecurity is also a critical concern as IoT device connectivity increases in industrial environments. The risk of cyberattacks on production systems can impact sensitive OHS data and operational control systems, making data protection and network security an integral part of IoT implementation strategies.

Current literature reviews still indicate a research gap in empirical studies directly measuring the impact of IoT on the effectiveness of OHS Management Systems (SMK3), particularly in the Indonesian automotive industry. Many studies are general in nature, focusing on manufacturing or global contexts, without focusing on the automotive sector or specific regions such as Indonesia (Yusuf et al., 2025).

In addition, the differences in previous research findings regarding the contribution of digital technology to the effectiveness of occupational safety indicate the need for further investigation to understand contextual factors such as organizational structure, safety culture, and human factors variables in the adoption of new technology (Yusuf et al., 2025).

This research is important because the effectiveness of an OHSMS needs to be measured multidimensionally, encompassing technical, behavioral, and organizational aspects, so that the contribution of IoT can be comprehensively assessed. This multidimensional approach includes evaluating outcomes such as incident reduction, safety compliance, and worker perceptions of smart safety interventions.

By expanding the empirical evidence on the impact of IoT in the automotive industry, this research is expected to provide a theoretical contribution in the form of a more systematic understanding of the relationship between digital technology adoption and occupational safety management outcomes. Practically, the results of this study can guide companies in designing effective technology implementation strategies to support OHS performance. However, empirical evidence quantifying the direct impact of IoT implementation on OHSMS effectiveness, particularly in the Indonesian automotive sector, remains limited and fragmented.

METHODS

This study uses a quantitative approach with an explanatory research type, which aims to empirically test the effect of the implementation of the Internet of Things (IoT) on the effectiveness of the Occupational Safety and Health Management System (SMK3) in automotive companies. The quantitative approach was chosen because it allows for objective measurement of research variables

and testing of causal relationships through inferential statistical analysis. This study is designed to explain the extent to which the implementation of IoT technology contributes to increasing the effectiveness of the OHS management system in the context of the automotive industry.

The research design used was cross-sectional, where data collection was conducted over a specific time period without any specific treatment given to the research subjects. This design is considered appropriate as it enables the assessment of relationships between variables at a single point in time. This approach allowed researchers to obtain an empirical picture of the relationships between variables based on respondents' perceptions and experiences at the time of the study.

The research was conducted at an automotive company that has implemented or is developing IoT-based technology in its production activities and occupational safety systems. The study population included all employees directly involved in the management and implementation of OHS, including OHS officers, production supervisors, technicians, and production line operators. Purposive sampling was used, with respondents having knowledge and experience related to IoT implementation and OHS management systems in their respective companies.

The independent variable in this study is the implementation of the Internet of Things (IoT), defined as the level of utilization of sensor-based technology, smart devices, and digital monitoring systems to support occupational safety risk control. The dependent variable is the effectiveness of the Occupational Health and Safety Management System, defined as the system's ability to prevent workplace accidents, detect and control risks early, and improve compliance with occupational safety procedures. Each variable is measured using a number of indicators compiled based on a literature review and adapted to the context of the automotive industry.

Primary data collection was conducted using a closed-ended questionnaire with a five-point Likert scale, ranging from strongly disagree to strongly agree. The questionnaire was designed to comprehensively measure respondents' perceptions of the level of IoT implementation and the effectiveness of the OHSMS. Additionally, secondary data was obtained from internal company documentation, such as OHS reports and occupational safety policies, to support and strengthen the empirical analysis.

Prior to further analysis, the research instrument was tested for validity and reliability. Validity was tested using Pearson Product Moment correlation to ensure each item measured the intended construct. Reliability was tested using Cronbach's Alpha coefficient to ensure the instrument's internal consistency. An instrument was deemed reliable if the Cronbach's Alpha value was greater than 0.70.

Data analysis was conducted through several stages, namely descriptive statistical analysis to describe the characteristics of respondents and the distribution of answers, followed by classical assumption tests including normality, heteroscedasticity, and multicollinearity tests. Furthermore, hypothesis testing was conducted using linear regression analysis to determine the effect of IoT implementation on the effectiveness of SMK3. The significance of the effect was tested using a t-test, while the magnitude of the contribution of the independent variables to the dependent variable was analyzed using the coefficient of determination (R^2).

This study has several limitations that should be considered when interpreting the findings. First, the use of a cross-sectional research design limits the ability to establish causal relationships between IoT implementation and OHSMS effectiveness. Second, the study was conducted within a

single company setting, which may restrict the generalizability of the results to other industries or organizational contexts. Third, data collection relied primarily on self-reported questionnaires, which are subject to respondent bias and may not fully reflect actual workplace conditions. Additionally, the use of a single data collection method introduces the potential for common method bias, which may inflate the observed relationships between variables. Future studies are recommended to adopt longitudinal designs, multi-company samples, and mixed-method approaches to enhance robustness and external validity.

RESULTS

1. Characteristics of Research Data

This study involved 120 respondents, consisting of OHS officers, production supervisors, technicians, and production line operators at an automotive company that has implemented IoT technology in its workplace safety system. All data were declared valid and reliable based on instrument testing results.

2. Descriptive Statistics of Internet of Things (IoT) Implementation Variables

Table 1. Descriptive Statistics of IoT Implementation Variables

IoT Implementation Indicators	Mean	Standard Deviation	Minimum	Maximum
Utilization of work environment sensors	4.12	0.58	2	5
Use of OSH wearable devices	3.98	0.64	2	5
Real-time monitoring of working conditions	4.25	0.55	3	5
IoT data integration with OHSMS	3.87	0.69	2	5
IoT-based early warning system	4.18	0.60	3	5
Average IoT Variable	**4.08**	**0.61**	**—**	**—**

The overall mean value of the IoT implementation variable is 4.08, indicating that the level of IoT implementation in the automotive company's OHS system is relatively high. The indicator with the highest mean value is real-time monitoring of working conditions (mean = 4.25), indicating that the company has optimally utilized IoT for continuous monitoring of work risks. The relatively low standard deviation (<0.70) indicates fairly homogeneous respondents' perceptions of IoT implementation.

3. Descriptive Statistics of the Effectiveness Variable of the Occupational Health and Safety Management System (OHSMS)

Table 2. Descriptive Statistics of SMK3 Effectiveness Variables

SMK3 Effectiveness Indicators	Mean	Standard Deviation	Minimum	Maximum
Prevention of work accidents	4.20	0.56	3	5
Early detection of occupational risks	4.15	0.59	3	5
Compliance with K3 procedures	4.05	0.63	2	5
Speed of response to danger	4.18	0.57	3	5
Reliability of the K3 reporting system	3.95	0.66	2	5

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Average SMK3 Variable	**4.11**	**0.60**	**—**	**—**

The average effectiveness score of the OHSMS was 4.11, indicating that the OHS management system in automotive companies is running effectively. The occupational accident prevention indicator had the highest score (mean = 4.20), indicating that the OHS system is capable of functioning as a preventive mechanism. The moderate standard deviation value indicates the consistency of respondents' perceptions of the OHSMS's performance.

4. Comparison of Descriptive Statistics of Research Variables

Table 3. Summary of Descriptive Statistics of Research Variables

Variables	Mean	Standard Deviation	Category
IoT Implementation	4.08	0.61	High
Effectiveness of SMK3	4.11	0.60	Effective

Descriptive statistics show that high levels of IoT implementation are associated with high OHSMS effectiveness. The relatively balanced mean values between the two variables indicate a strong potential relationship, making it feasible to proceed to inferential analysis to test the causal influence between the variables.

Linear Regression Analysis Results

1. Linear Regression Equation

Based on the analysis results, the following linear regression equation was obtained:

Y = 1.214 + 0.703X

This equation shows that increasing the implementation of IoT contributes positively to increasing the effectiveness of the OHS Management System.

2. Results of Partial Linear Regression Test (t-Test)

Table 4. Linear Regression Results of the Effect of IoT Implementation on the Effectiveness of SMK3

Independent Variables	β (Regression Coefficient)	t-count	Sig. (p-value)	Information
Constant	1,214	4,862	0,000	Significant
IoT (X) Implementation	0.703	9,417	0,000	Significant

The regression coefficient (β) value of 0.703 indicates that every one unit increase in IoT implementation will increase the effectiveness of SMK3 by 0.703 units, assuming other variables are constant. The calculated t-value (9.417) > t-table (±1.98) and the significance value of 0.000 < 0.05, so the hypothesis stating that IoT implementation has a significant effect on the effectiveness of SMK3 is accepted.

3. Coefficient of Determination (R^2)

Table 5. Determination Coefficient of Regression Model

Model	R	R Square (R^2)	Adjusted R^2	Std. Error
1	0.742	0.551	0.547	0.384

The R Square (R^2) value of 0.551 indicates that 55.1% of the variation in the effectiveness of the OHS Management System can be explained by the implementation of IoT. Meanwhile, the

remaining 44.9% is influenced by other factors outside the research model, such as safety culture, OHS leadership, workforce training, and other organizational factors. The Adjusted R^2 value, which is close to R^2, indicates that the regression model has a good level of accuracy.

DISCUSSION

Despite the strong statistical relationship observed, the findings should be interpreted cautiously due to methodological constraints and contextual limitations in automotive companies, with a regression coefficient value of 0.703 and $R^2 = 0.551$. This indicates that 55.1% of the variation in SMK3 effectiveness can be explained by the level of IoT implementation, while the remaining 44.9% is influenced by other factors such as safety culture, leadership, and human resource readiness. Empirically, the higher the level of IoT adoption in the K3 system, the more effective the organization is in carrying out early detection, risk control, and real-time mitigation of work accidents.

Theoretically, these findings align with the concept of Cyber-Physical Systems (CPS) within the Industry 4.0 framework, which emphasizes the integration of physical and digital systems to create a smart, efficient, and safe work environment. IoT is a key foundation in CPS (Cyber-Physical Systems) due to its ability to connect machines, devices, and workers through continuous data communication that supports data-driven decision-making (Yusuf et al., 2025). This approach shifts the paradigm of occupational safety management from reactive to proactive and predictive, where sensor data is used to prevent accidents before they occur.

Several contemporary studies support these findings. Misra et al. (2022) concluded that the implementation of the Industrial Internet of Things (IIoT) improves safety management effectiveness through automated sensor systems capable of quickly and accurately identifying operational anomalies (Misra et al., 2022). Similarly, Arana-Landín et al. (2023) found that the implementation of Industry 4.0 technologies, including IoT and big data analytics, significantly improved worker compliance and safety in the automotive sector, with key improvements in early warning systems and digital reporting (Arana-Landín et al., 2023). Similar results were also demonstrated by Nioata et al. (2025), who reported that the implementation of IoT in smart manufacturing systems in the automotive industry reduced occupational risk levels by 32% and increased overall safety system reliability (Nioata et al., 2025).

In the context of worker behavior and well-being, Hadi et al. (2025) demonstrated that IoT-based wearable devices with artificial intelligence (AI) can improve worker safety behavior through biometric monitoring and real-time fatigue detection (Hadi et al., 2025). Meanwhile, Canizalez et al. (2024) emphasized that the success of IoT implementation in OHS systems is influenced by the digital literacy of the workforce and the level of technology acceptance in the industrial environment (Canizalez et al., 2024). In addition to technological factors, organizational readiness is also an important element, as outlined by Bochkovskyi & Sapozhnikova (2021), who developed a digital-based OHS automation system and emphasized the need for synchronization between old and new systems to maintain data effectiveness and security (Bochkovskyi & Sapozhnikova, 2021).

Based on these results, researchers assume that the success of IoT implementation in improving the effectiveness of SMK3 depends not only on technology integration, but also on the level of digital readiness of the organization and the competence of the human resources operating

it. IoT is considered a key enabler that can improve the predictive capabilities of safety systems, but its benefits can only be maximized if supported by a strong safety culture, continuous technology training, and strict cybersecurity policies. Researchers also assume that the combination of IoT and artificial intelligence data analytics will be the direction of SMK3 development in the future, given the great potential of these two technologies in creating a more adaptive and autonomous occupational safety system.

Thus, this study confirms that IoT plays a strategic role in the transformation of the OHS management system towards a proactive, adaptive, and sustainable data-driven safety management model in the digital era of the automotive industry.

Practical Implications

Based on the findings, several structured recommendations can be proposed to enhance the effectiveness of IoT implementation in OHSMS:

1. Digital Readiness Assessment

Organizations should conduct a comprehensive digital maturity assessment covering infrastructure readiness, workforce digital literacy, and system integration capabilities before implementing IoT solutions.

2. Phased Implementation Strategy

IoT adoption should follow a staged approach:

a) pilot testing of sensor-based monitoring systems,
b) system integration with existing OHSMS platforms,
c) full-scale deployment with real-time analytics.

3. Workforce Training Framework

Companies need to design structured training programs focusing on:

a) IoT system operation
b) data interpretation for safety decision-making
c) digital safety awareness

4. Data Governance and Cybersecurity

Implementation must include strong cybersecurity protocols, including data encryption, access control systems, and continuous monitoring of network vulnerabilities.

5. Continuous Evaluation System

Organizations should establish key performance indicators (KPIs), such as incident reduction rate, response time, and system reliability to evaluate IoT effectiveness continuously.

CONCLUSIONSsssss

This study proves that the implementation of the Internet of Things (IoT) has a positive and significant impact on the effectiveness of the Occupational Safety and Health Management System (SMK3) in automotive companies. The regression coefficient value of 0.703 and the coefficient of determination (R^2) of 0.551 indicate that IoT contributes significantly to improving the effectiveness of the K3 system through real-time monitoring of working conditions, early detection of potential hazards, and increased compliance with safety procedures. These results confirm that IoT is not just a monitoring tool, but has become a core element in data-driven safety management.

Theoretically, this research strengthens the Cyber-Physical Systems (CPS) paradigm in the context of Industry 4.0, which positions the integration of digital technology as a key driver of increased safety management system effectiveness. The implementation of IoT enables organizations to shift from a reactive approach to data-driven safety management, where sensor data analysis and predictive algorithms are used to anticipate occupational risks adaptively and sustainably.

From a practical perspective, the results of this study provide strategic implications for the automotive industry and other manufacturing sectors. The integration of IoT into OHS systems can serve as a model for developing more responsive, efficient, and technology-based safety policies. Organizations are advised to strengthen their digital infrastructure, cybersecurity, and workforce technical competencies to optimize the benefits of IoT without creating new risks related to privacy and data security. Furthermore, the implementation of this technology needs to be accompanied by ongoing training and the development of a digital safety culture, so that workers can adapt to technological transformations in the workplace.

Future research should explore longitudinal and multi-industry approaches to validate the scalability and sustainability of IoT-based safety systems.

REFERENCES

Arana-Landín, G., Laskurain-Iturbe, I., Iturrate, M., & Landeta-Manzano, B. (2023). Assessing the influence of industry 4.0 technologies on occupational health and safety. *Heliyon*, *9*(3), e13720. https://doi.org/10.1016/j.heliyon.2023.e13720

Bochkovskyi, A. P., & Sapozhnikova, N. Yu. (2021). Development of system of automated occupational health and safety management in enterprises. *Journal of Achievements in Materials and Manufacturing Engineering*, *1*(107), 28–41. https://doi.org/10.5604/01.3001.0015.2454

Budiono, C. E., Lukman, H., Sekar, Ramadani, N. A., Hendrawan, N. F., Mirachel, L., Zannah, Q., En, Z., & Dwianti, A. S. (2025). From Sensors to Safety: IoT-Enabled Smart Helmets as a Game-Changer for Worker Protection in High-Risk Industries. *Health Frontiers: Multidisciplinary Journal for Health Professionals*, *3*(1), 30–42. https://doi.org/10.62255/mjhp.v3i1.164

Canizalez, Y. G., Barreto, J. S., Suarez, R. M., & B. Rodriguez. (2024). Technologies for safety and health management in large companies in Ecuador: A worker-centric exploration from technology adoption attitudes. *Journal of Applied Research and Technology*, *22*(6), 897–906. https://doi.org/10.22201/icat.24486736e.2024.22.6.2399

Deshvena, Y. N., & Kulkarni, R. R. (2024). IoT-enhanced Real-time Monitoring and Hazard Detection. *STM Journals*, *11*(02). https://journals.stmjournals.com/joise/article%3D2024/view%3D170968/?utm_source=chatgpt.com

Eurogip (2024) *Two case studies on digital technology and OHS in the automotive industry*, 27 December. https://eurogip.fr/en/two-case-studies-on-digital-technology-and-ohs-in-the-automotive-industry/.

Hadi, A., Ali, F., Kumar, S., Ayesha, & Ahmed, B. (2025). Wearable Iot Devices With Ai For Occupational Health: Real-Time Worker Monitoring And Safety Analytics. *Journal of Medical & Health Sciences Review.*, *2*(2). https://doi.org/10.62019/77c8jx73

IoT For All (2024) *5 IoT solutions for industrial safety*, 21 November. https://www.iotforall.com/5-iot-solutions-for-industrial-safety.

Kumbhakarna, J., Gunde, K., Madiha, S., Ghatge, R., Dhotre, S., & Puskar, M. (2025). IoT-Based Industrial Safety Management Systems» JoISE. *STM Journals*, *12*(01). https://journals.stmjournals.com/joise/article%3D2025/view%3D232938/?utm_source=chatgpt.com

Mahrani, A., Magdalena, K., Sevensari, T., & Kurnia, H. (2025). Implementation of the Internet of Things (IoT) in Production Performance Monitoring and Optimization: A Systematic Literature Review. *Industry Xplore*, *10*(2). https://doi.org/10.36805/n8wpc368

Maintworld (2025) *How and why IoT enhances manufacturing safety*, 5 June. https://www.maintworld.com/News/How-and-why-IoT-enhances-manufacturing-safety.

Mayori, E., Sungkono , & Kerta Widana, I. D. K. (2025). Development of an IoT-Based Occupational Health and Safety Monitoring System in the Pulogadung Industrial Estate. *Jurnal Teknik Industri Terintegrasi*, *8*(4), 4292–4301. https://doi.org/10.31004/jutin.v8i4.50921

Misra, S., Roy, C., Sauter, T., Mukherjee, A., & Maiti, J. (2022). Industrial Internet of Things for Safety Management Applications: A Survey. *IEEE Access*, *10*, 83415–83439. https://doi.org/10.1109/ACCESS.2022.3194166

Nioata, A., Ţăpirdea, A., Chivu, O. R., Feier, A., Enache, I. C., Gheorghe, M., & Borda, C. (2025). Workplace Safety in Industry 4.0 and Beyond: A Case Study on Risk Reduction Through Smart Manufacturing Systems in the Automotive Sector. *Safety*, *11*(2), 50. https://doi.org/10.3390/safety11020050

Prithiviraj, A. (2025) *Decision-Making in Automotive Working Employee Safety Projects Using AI with IoT-Driven Analytics*. IGI Global. https://www.igi-global.com/chapter/decision-making-in-automotive-working-employee-safety-projects-using-ai-with-iot-driven-analy.

Telit (2025) *Automotive manufacturing and Industry 4.0: 2 case studies*, 28 May. https://www.telit.com/blog/iot-applications-automotive-manufacturing-case-studies/.

Wahidin, A. A. (2025). Literature Review on the Implementation of the Internet of Things (IoT) in Occupational Health and Safety Systems within the Manufacturing Industry. *Jurnal Sanitasi Lingkungan*, *5*(2), 67–74. https://doi.org/10.36086/jsl.v5i2.2952

Yusuf, M., Bahl, A., Haleem, A., Javaid, M., Bahl, S., & Shelare, S. (2025). Internet of Things Applications for Enhancing Occupational Health and Safety in Industry 4.0 Settings: A Scoping Review. *Journal of Industrial Integration and Management*, 1–18. https://doi.org/10.1142/s2424862225300017

Zahra, Mokhtarinia, H. R., Vahedi, M., & Melloh, M. (2025). Prevalence and multivariate analysis of risk factors associated with musculoskeletal disorders among automotive assembly workers: a cross-sectional study. *BMC Public Health*, *25*(1). https://doi.org/10.1186/s12889-025-23987-4