Automated Health and Safety Recommendations Using LSTM in Hazardous Workplaces

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ABSTRACT

Monitoring of workplace conditions and employee health is crucial to ensuring worker safety and compliance with regulatory standards. In environments where exposure to hazardous factors such as chemicals, noise, or extreme temperatures is common, real-time tracking of exposure levels can help prevent health risks. This study presents a recommendation system based on Long Short-Term Memory (LSTM) networks, designed to monitor and predict workplace exposure risks using sequential data. The system leverages preprocessed exposure data, including environmental conditions and worker-specific health information, to generate personalized safety recommendations. By analyzing historical exposure patterns, the LSTM model identifies potential hazards and suggests timely interventions, such as protective measures or adjustments to work schedules. The system also integrates real-time alerts, which are generated when exposure levels exceed predefined limits, ensuring workers receive immediate safety instructions.

INTRODUCTION

Real-Time Monitoring of Workplace Conditions and Employee Health involves continuously tracking and evaluating various environmental and health parameters to ensure the safety and well-being of employees. The integration of advanced technologies such as IoT sensors, machine learning models, and mobile applications allows for the real-time collection and analysis of data, enabling immediate actions to be taken if any workplace conditions exceed predefined safety thresholds. The main goal of real-time monitoring is to detect and mitigate potential health risks promptly, enhancing both employee health and productivity in the workplace.

In this system, monitoring devices are used by employees during their work shifts to measure environmental conditions such as exposure to hazardous substances, temperature, humidity, and noise levels. These devices continuously collect data and transmit it to a central server via Wi-Fi. The server processes this data and checks if any parameters exceed the predefined safety limits. If any dangerous levels are

detected, the system generates alerts through visual signals, such as LED lights on the monitoring devices, or notifications to supervisors, helping to ensure that appropriate actions are taken in real time.

The server plays a crucial role in this ecosystem, functioning as the central hub where all data is collected, analyzed, and stored. This cloud-based platform provides access to detailed employee health records, including exposure levels, health metrics, and the status of alerts. Web applications allow employers to manage employee health data, report changes such as dismissals or retirements, and monitor alerts. In the future, the server will also integrate machine learning models to predict potential health risks based on historical data, providing proactive measures and personalized recommendations for each worker.

Employees benefit from this real-time monitoring system through a mobile application that allows them to track their exposure levels and health metrics in real time. They can view a summary of their daily data or dive deeper into historical information. The mobile app also empowers employees to take necessary actions to protect their health, such as taking breaks, using protective gear, or notifying supervisors about abnormal exposure levels. This app helps maintain a healthy and safe work environment while ensuring that workers remain informed about their health status.

The integration of machine learning and AI into real-time monitoring systems takes the concept further by continuously learning from the data collected. With time, these models can predict future health risks based on employee behavior and historical exposure data. By integrating these advanced technologies, employers can not only comply with workplace safety regulations but also enhance the overall health and well-being of their workforce. This proactive approach to health monitoring in workplaces is becoming an essential tool for industries aiming to reduce occupational risks, improve employee satisfaction, and optimize productivity.

AI significantly enhances the real-time monitoring of workplace conditions and employee health by transforming vast amounts of data into valuable insights that can drive proactive safety measures. One of the primary ways AI contributes is through predictive analytics, where machine learning algorithms analyze both historical and real-time data to forecast potential health risks. For example, by identifying patterns in exposure data, AI can predict when an employee is at risk of overexposure to hazardous substances or dangerous environments, enabling the system to generate proactive alerts and suggest preventive actions. This predictive capability helps reduce the likelihood of accidents or health issues before they occur.

Another key function of AI is anomaly detection, where it continuously monitors data from sensors and devices for unusual patterns that might indicate unsafe conditions. If exposure levels exceed predefined limits, AI can automatically identify this and trigger alerts, ensuring that corrective actions are taken quickly. This can be particularly important in environments where exposure to dangerous chemicals, excessive noise, or other hazards poses a significant risk to employee health. AI's ability to detect these anomalies in real time allows for immediate intervention, preventing potential health hazards.

AI also plays a crucial role in health monitoring by integrating data from wearable devices, such as heart rate, fatigue, and sleep quality, to assess the overall health of employees. By analyzing this data, AI can identify correlations between an employee's health and their work environment, offering a more comprehensive understanding of how workplace conditions may impact their well-being. For example, AI might identify that high stress levels correlate with increased exposure to certain hazards, prompting the system to notify both the worker and supervisors of potential risks.

Moreover, AI offers personalized recommendations based on an individual employee's health data and exposure history. By considering factors such as the employee's previous exposure to hazardous substances or patterns in their health metrics, AI can suggest tailored protective measures, such as tak-