**Industrial Workers Health And Safety System Based On Internet Of Things**

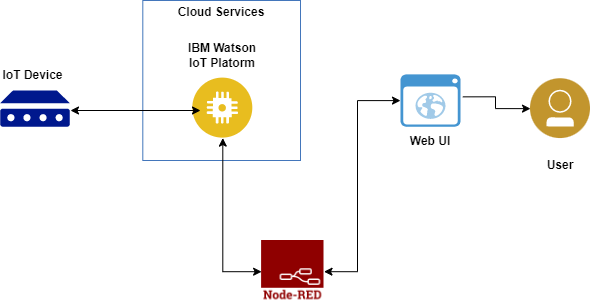
**ABSTACT**

In recent days, the innovation towards a new occupational health and safety group in which work cultures are directed towards active safety values. It is predicted that the safety analysis techniques now in place are quite difficult to address the potential risks which weaken the era. A novel approach to analyzing different crucial criteria in various industrial sectors is explained carefully in this work. In this unique approach, accident reduction model technique is applied to determine the respective weights of three main criteria and seventeen sub-criteria as a way of enriching the decision-making process while in a problem. A survey was initiated in different industrial sectors to obtain reliable data for the research. The results show that the main criteria ‘human safety’ acquired a weight of 72.5% while the respective weights of primary criteria machine security and work environment safety fall to 8.9 and 18.4%. The weight of the main criteria, human safety indicates that the sub-criteria such as eye protection, manual lifting, material handling practices, firefighting drills, training and safety officers are implemented to a greater extent in most of the surveyed industries.

**PROJECT DESCRIPTION**

With the help of sensors attached to the shoes of the workers, the information such as the temperature measure, altitude parameters, the total distance walked is recorded and sent to the cloud for storage. This data will be visualised in the mobile application and through a web application,  the authorities can check every worker's status. If someone is working on the higher altitudes, important and required precautions are sent to them, thus increasing their safety.

**TECHNICAL ARCHITECTURE**



**PROJECT OBJECTIVES:**

By the end of the project, you will:

* Gain knowledge of Watson IoT Platform
* Explore Wokwi Platform
* Explore the devices and its simulation of the wokwi platform.
* Explore the libraries present in Wokwi.
* Will be able to code to connect the devices across the cloud platform.
* Connecting the devices on wokwi to the IoT platform device to exchange the sensor data.
* Gain knowledge of creating devices and platforms using IBM Watson IoT Platform.
* Gain knowledge of web application development through node-red.

**EXISTING SYSTEM &CONCLUSION:**

IoT integrates smart and intelligent devices with the existing industrial systems. As a result, various industrial sectors have undergone a considerable transformation. The safety of workers is one of the essential aspects of concern. Any form of violation of the industrial safety protocols may result in the damage or loss of property and human lives. Such incidents are also detrimental to the workforce’s morale and impede the standard work processes in the industry. IIoT helps to attain these safety goals and implement them to improve the overall workplace safety. We primarily focus on the industries with high safety management levels, risk of incurring substantial economic losses, and possessing time-sensitive workflows. Considering these aspects, we selected the following industries – healthcare, transportation, manufacturing, and mining, to survey the existing research works. Further, we identified the risks involved, explored the research lacuna in mitigating these risks, and provided future research directions to fill the gap. There are various risks involved in the healthcare industries such as exposure to infections, improper waste disposal, fire hazards, storage of food and medicines, equipment failure, and chemical hazards in the laboratories. Real-time monitoring and appropriate communication system help to maintain the safety levels of a patient. Moreover, certain other auxiliary factors such as medical waste disposal and management, VOLUME 10, 2022 83433 S. Misra et al.: Industrial Internet of Things for Safety Management Applications: A Survey medical equipment maintenance, and infrastructure management play essential roles in the healthcare industry. Mobile healthcare (m-health) constitutes healthcare applications with the integration of advanced sensors and technologies. The use of RFID tags and bar codes helped in the management of the assets and improved tracking of the status of medicines given to the patients. Similarly, the diverse form of risks/hazards in the transportation industry includes collisions and accidents, fire hazards, and workplace accidents due to rapid movements on the factory floor. The safety standards of on-road vehicles are monitored, drowsiness of the drivers are detected, vehicular channel measurements, and provision of real-time information to the end-users may reduce the rate of accidents. Certain real-time assistance systems were also developed for providing safety-related information to the drivers, tools were designed for analysis of crash data, and learning-based models were proposed to upgrade the on-road safety of drivers and pedestrians. Further, the nature of cargo such as radioactive, inflammable, and chemical, acts as one of the critical factors in deciding the safety of the vehicles categorized under logistics. Various IIoT solutions such as digital twins are being developed to improve safety management in the transportation industry. In the manufacturing industry, the risks involved include the different accidents and incidents on the factory floor due to hazardous environments, involvement of human operators, and fire hazards. Electrical safety forms an essential aspect of concern at the workplace because electrification has brought a massive transformation across the diverse manufacturing industries. Different types of automation techniques are introduced, SISs are developed, and industrial communication systems are designed to provide real-time data to the workers and upgrade their safety. With the development of smart factories, humans and robots collaboratively work on the factory floor. Additionally, the integration of smart devices, real-time data collection, processing, and transfer of information in the manufacturing industries has lead to the development of ‘‘industrial networks’’. Further, the digital transformation and 5G/B5G infrastructure are projected to play essential roles in industrial automation. On the other hand, in the mining industries, the underground miners also suffer from various health hazards, injuries, and diseases, depending on their workplace locations and environments. Various factors such as fires, flooding, roof collapse in underground mines, and workplace accidents are the risks involved in the mining industry. Additionally, coal dust, silica dust, and other powdered materials also possess threat to the health of the miners. To avoid the adverse effects of dust and other pollutants in underground mines, zeroemission vehicles are introduced, emergency management and response training are given, and communication systems are developed. Further, the use of autonomous vehicles has resulted in the improvement of the safety of miners. Communication inside the underground mines is another essential aspect of concern. Different underground communication systems such as wired, radio, current, and hybrid, exist. However, for the evacuation of miners during an emergency, improved communication performance is necessary. An SOA-based four-layered IIoT infrastructure – sensorequipped device, intermediate device, processing, and interface, was developed for provisioning seamless safety information to the workers across diverse industries. In this platform, heterogeneous types of sensor nodes are deployed at various geographical locations or machines in the device layer. These sensor nodes sense and transmit data to the intermediate device layer, which comprises edge/fog nodes. Further, complex analysis and processing of the data are performed in the processing layer. The customers register, select services, and make payments through the interface layer. Another similar infrastructure, Safety-as-a-Service (SafeaaS) platform, was discussed, which provides a customized, safety-related decision to the end-users. Further, several challenges exist in integrating heterogeneous data generated from the sensor nodes, security and privacy of the generated data, lack of a standard platform, and implementation of the theoretical and prototypes developed in the industrial scenario, are quite difficult. Additionally, proper training and awareness of the workers are also necessary. IIoT can be employed to minimize hazards and risks caused to the personnel across diverse industries, and upgrade their safety. The evolution of 5G/B5G and beyond technologies will gear up automation across the diverse industrial sectors. To summarize, the interconnectivity and communication among the units in the industry is always advantageous and productive, in terms of safety. IIoT significantly enhances these capabilities of the industries, thereby enhancing the safety in its environment and promotes seamless management.