A Dangerous Occasion Monitoring and Management System

Chen, Yike (School: Barrington High School)
Cheng, Dawen (School: Barrington High School)
Xiong, Yiming (School: Barrington High School)

Data from the ILO reports that 337 million work accidents occur annually, with 2.3 million of such events resulting in fatalities. Though regulations exist to uphold worker safety, these standards are not properly maintained in every facility. The objective of this project is to create a system of user-monitoring wristbands that provides a needed layer of security for workers, addressing potential safety violations and preventing workplace injury. To recognize emergency situations, our system implements a fall detection algorithm, consisting of multiple decision trees and a pretrained machine learning model utilizing gyroscope and accelerometer data, and an algorithm that detects physiological abnormalities, utilizing heart rate and blood oxygen data collected from a pulse oximeter. Furthermore, as a part of our zone-tracking capabilities, the position of each wristband is calculated to approximately 0.3 meter precision through BLE beaconing. To ensure the reliability of our zone-tracking component, we developed supplemental fail-safe systems including passive far-field RFID tracking, which requires no energy to operate, and a computational redundancy mesh, which allows for the dynamic allocation of communication routes. A remote wireless power distribution system acts as a continuous secondary energy source for each wristband and other low-power consumption nodes. The prototype of our system demonstrated remarkable precision, accuracy, and consistency. All aforementioned focuses were well satisfied. The final prototype was a combination of self-designed modules and general, sourceable components that underwent over 200 hours of testing. Full-scale production and implementation may be possible in the near future.

Awards Won:
Second Award of $2,000