Urban ad-hoc roadway construction zones: Human worker behavior evaluation towards safety notifications

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Can alarm devices improve worker safety?

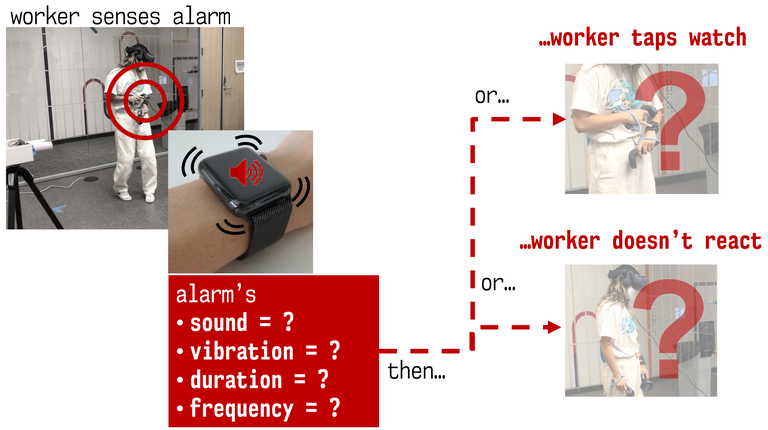
762 crashes[1]
135 worker deaths

Minimal safety measures in urban ad-hoc work zones contribute to roadside accidents.

Stationary active alarm devices difficult for workers to hear or see in work zone environments. Workers **tend to ignore** these alarms [2] .

Do wearable alarm devices trigger reactions?

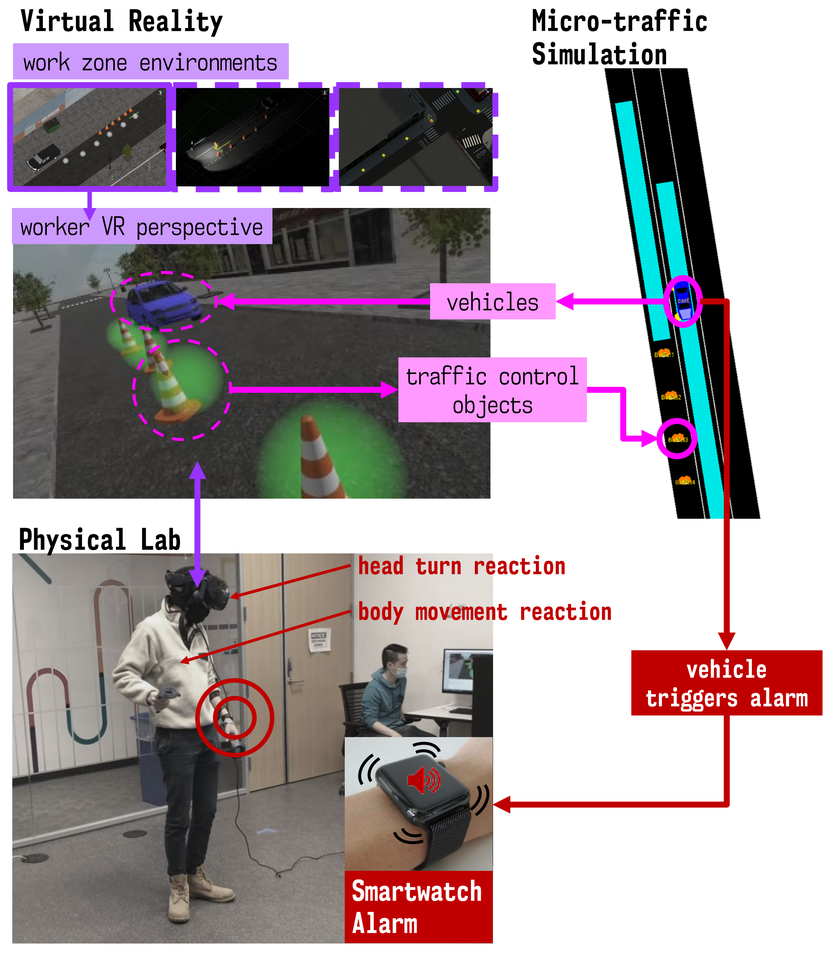
Wearable devices (e.g., smart watches, haptic vests) can ensure workers notice safety alarms. But how workers **react to different alarm characteristics (sound/vibration, duration, frequency)** are still not well understood.



Integrated virtual reality and micro traffic simulation platform

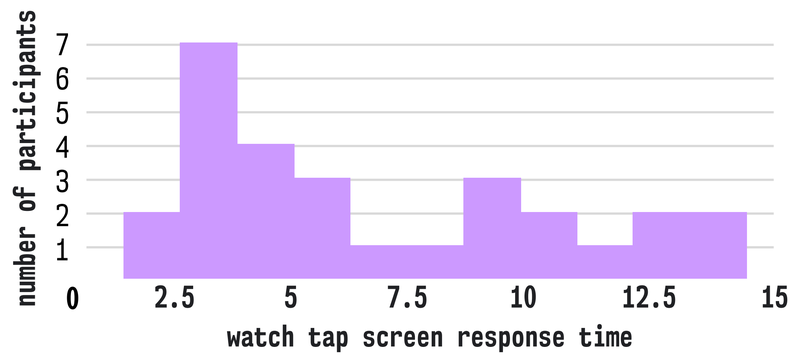
Testing alarm devices in real construction sites or physical roadway testbeds is not safe or effective **for testing a wide variety of vehicle related accident scenarios.**

The platform utilizes sensors to measure different **forms of worker reactions (watch face response, gaze direction, etc.)** to alarms of **random characteristics (sound/vibration, duration, frequency).**

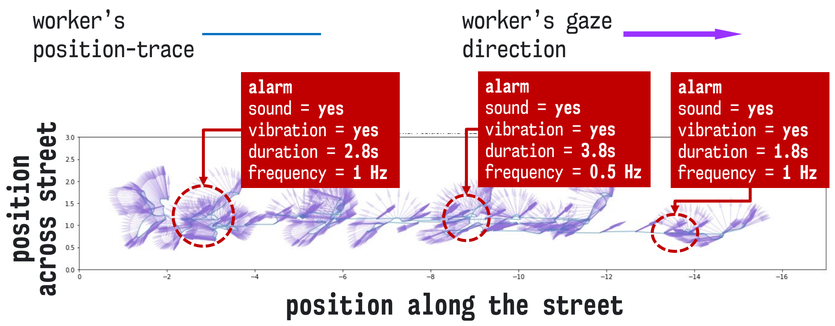


Data collection on worker reactions

Collected data from **thirty-three (n=33) participants** using the platform to evaluate worker reactions to alarms.



Currently analyzing the captured data on worker behavior for developing a **reinforcement learning-based model to calibrate alarm characteristics** for achieving faster physical reactions from workers.



Expected Contributions and References

An improved **alarm control system** that optimizes alarm characteristics to evoke faster physical reactions from workers during a workday.

1. Bureau of Labor Statistics (2019), 2019 National Work Zone Fatal Crashes & Fatalities, retrieved from "https://www.workzonesafety.org/crash-information/work-zone-fatal-crashes-fatalities/" access date: 11/27/2021.
2. TxDOT (2002), Use of drone radar, safety intrusion alarms, CB Wizard, and automated flaggers in work zones, retrieved from "https://www.workzonesafety.org/practice/use-of-drone-radar-safety-intrusion-alarms-cb-wizard-and-automated-flaggers-in-work-zones/", access date: 11/27/2018.