Title: A Probabilistic Approach to Dynamic Hazard Zone Mapping in Highway Work Zones

Background:

Highway work zones pose significant risks due to the dynamic interplay of construction activities, vehicular traffic, and environmental conditions. Among the risks, the close proximity of workers to heavy construction equipment in work zones is a major issue, potentially leading to collisions and near misses. Traditional methods of hazard zone mapping rely heavily on static models that do not adequately account for the changing conditions in real-time. Recent advances in sensor technologies enable the collection of vast amounts of data within work zones. This wealth of data creates an opportunity to develop more precise, real-time hazard mapping methods that could enhance safety.

Objective:

The primary objective of this research is to develop a probabilistic approach to dynamic hazard zone mapping in highway work zones, taking into account the speed and direction of construction equipment in real time.

Problem Statements:

1. The existing static hazard zone mapping methods provide a simple circular zone which does not consider the speed of the vehicle and its direction. This will usually lead to a conservative hazard zone which is prone to false alarms, as workers in safe zones could also be alarmed.
2. The current approach typically represents the danger zone around a vehicle with a single circle, or sometimes two circles to differentiate between danger and warning zones, but it fails to depict the probability of hazards surrounding the vehicle. This new method will dynamically map the probability of hazards around the vehicle, providing a more nuanced and responsive safety model.

Ideas

In highway work zones where workers and equipment work in a congested environment, the conventional circular hazard zone will not be effective as it is prone to many false alarms being generated and consequently a more accurate hazard zone mapping is required.