WUI-NITY : A platform for the simulation of wildland-urban interface fire evacuation

Wildfires are an important safety issue in many regions of the world. They can threaten both rural and urban areas – affecting infrastructure and life safety. Wildfires prove to be a greater safety risk to populations bordering wildland areas, known as the wildland urban interface (WUI), having the potential to harm people and property. This study introduces a modeling platform, called WUI-NITY, for the simulation of human and fire behavior during a wildfire evacuation at the WUI. The scope of this platform is to enhance the situational awareness of responders and residents in evacuation scenarios providing information on the dynamic evolution of the situation. In contrast, information available is typically static (i.e. snapshots of information about the current or historic situation rather than predicted future conditions). The lack of dynamic information influences the effectiveness of decision-making for the training, planning and undertaking of evacuation scenarios. Therefore, WUI incidents present a unique challenge to citizens, planners and responders. The nature of the incident is enormously varied in how it starts and the factors that influence it, complex, dynamic both temporally and spatially. The work presented here assumes that decision-making in the preparation, training for and undertaking of WUI evacuation scenarios would benefit significantly from a broader range of predictive information that reflects the evolving conditions beyond the current timeframe.

Project Goal & Approach

This project aimed to develop an integrated software platform for the simulation of wildland urban interface (WUI) evacuation scenarios that can be used both before an incident for planning and during an incident to inform decisions.

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Summary Observations

This work represents a proof-of-concept for an integrated platform for the simulation of coupled fire spread, pedestrian response/movement and traffic evacuation.

The approach adopted here represents current and predicted conditions (fire, pedestrian and traffic) in a coupled manner, to generate a dynamic projection, enabling a similarly integrated and dynamic (i.e. changing along with the evolution of the fire scenario) vulnerability assessment. The concept of dynamic vulnerability mapping requires (1) the representation of multiple subject domains and (2) make predictions of what the capacity of communities to cope with those conditions. The proposed platform integrates different modeling layers and has both of these capabilities. The similuated results may then be in a number of forms:

- 2D mapped visualization showing how the fire, traffic and pedestrian responses evolve in real-time as the scenario progresses.
- Interpretations of this simulated evolution to map the identified dynamic vulnerability of the pedestrian populations given the conditions faced.

The main outut produced by the WUI-NITY platform are predictions generated by the coupled models, which is a unique and novel feature. These features allow the system to establish and map the dynamic vulnerability – representing the (lack of) capacity for simulated populations to cope with the conditions available and give the resources available. The information concerning dynamic vulnerability obtained with the WUI-NITY platform is useful for evacuation planners and emergency responders, as it gives the possibility to evacuation the dynamic vulnerability of an area given evolving conditions and fire scenarios. Overall, WUI-NITY has the potential to be implemented and help global WUI communities, to allow for better planning, training and practices during an event in preparation for WUI fires.

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