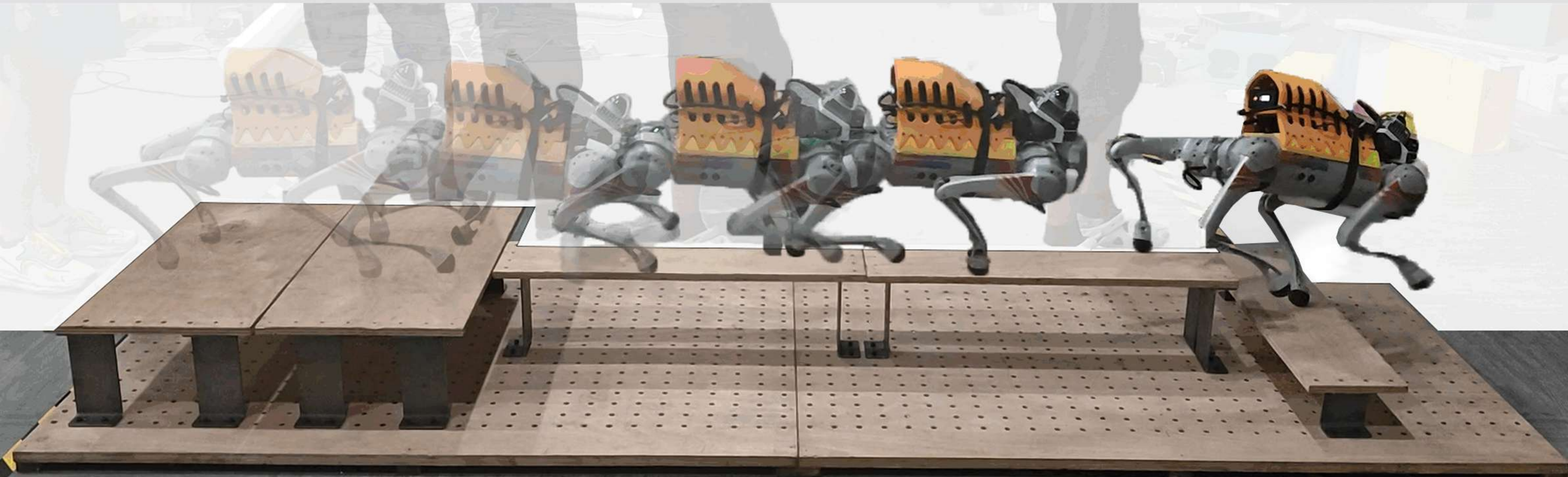


Filed-Deployable Quadrupedal Locomotion over Risky Gap Terrains Using Single-LiDAR Elevation

Li Wanyue, Dong Yinzhaoh, Ma Ji and Lu Peng
The University of Hong Kong, Hong Kong

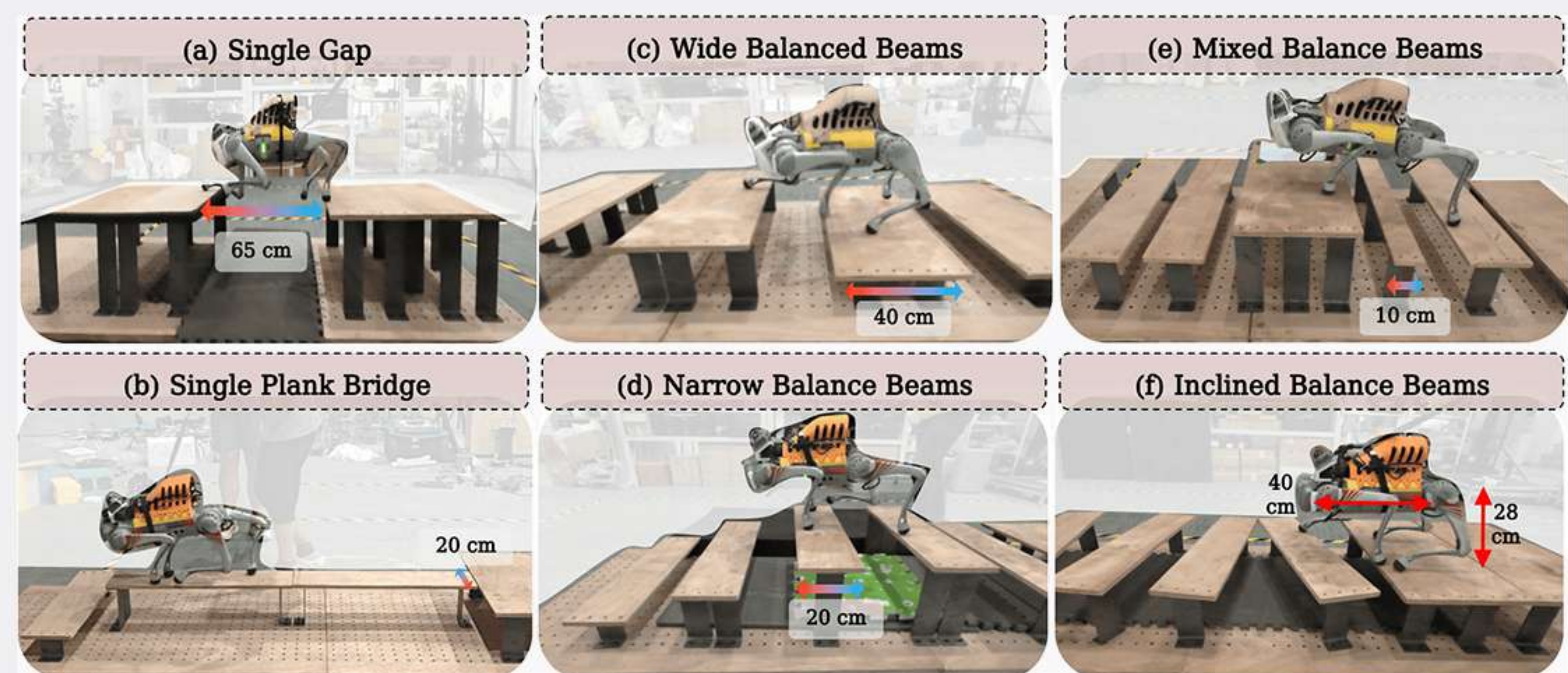


Our method enables stable real-world traversal over plank bridges and discontinuous balance beams using only onboard sensing.

Why Risky Gap Terrains Are Hard

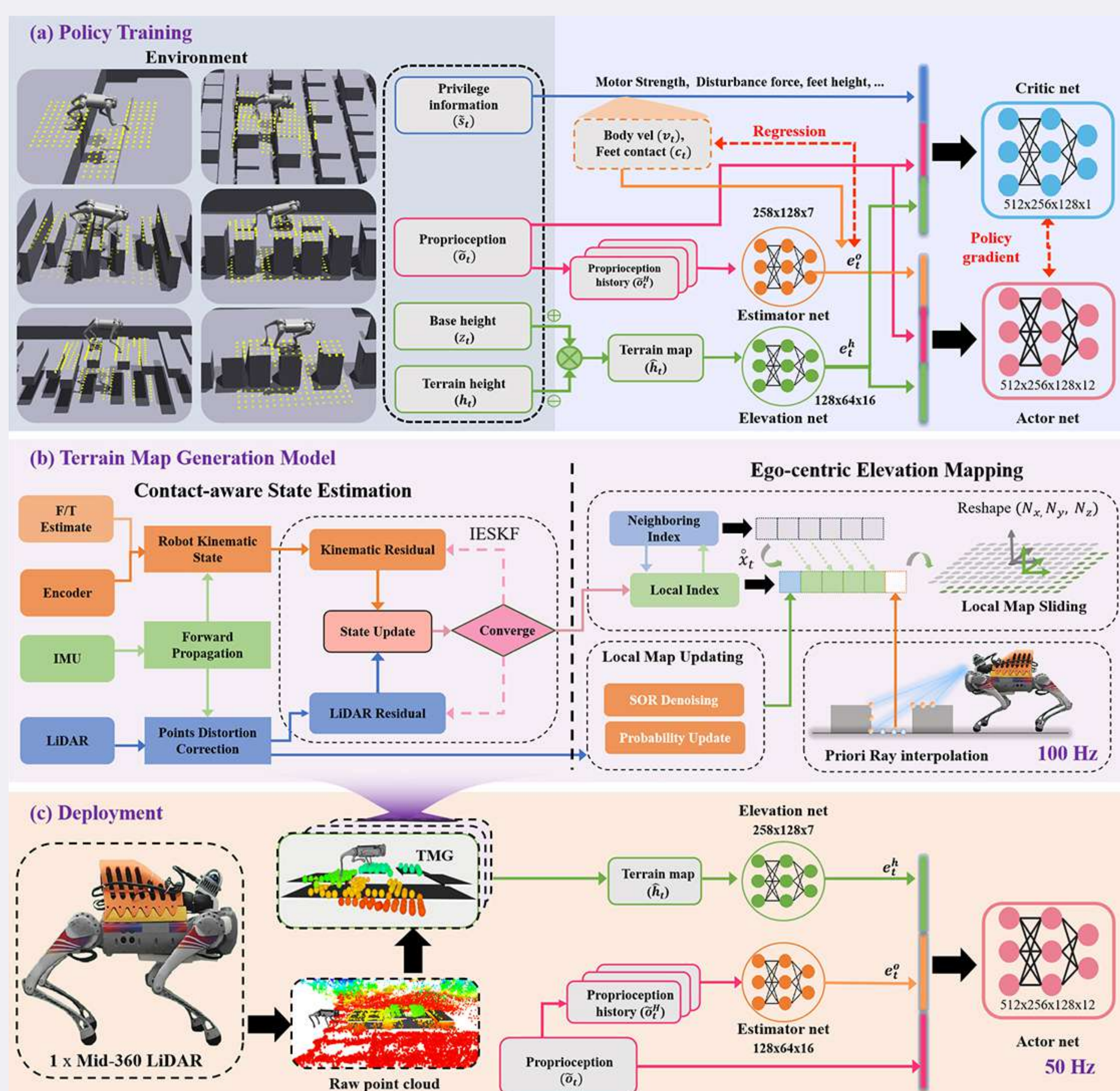
- Safe traversal requires accurate perception of discontinuous support geometry, which is difficult to maintain under mapping drift
- Blind locomotion often fails on narrow beams, plank bridges, and wide gaps, where small foothold errors can quickly lead to instability.
- Existing perception-driven systems may rely on complex sensing stacks, reducing practical deployability.

Experimental Scenarios



We evaluate the proposed system in indoor hardware experiments on six risky terrain configurations: single gaps, plank bridges, wide and narrow balance beams, mixed balance beams, and inclined balance beams.

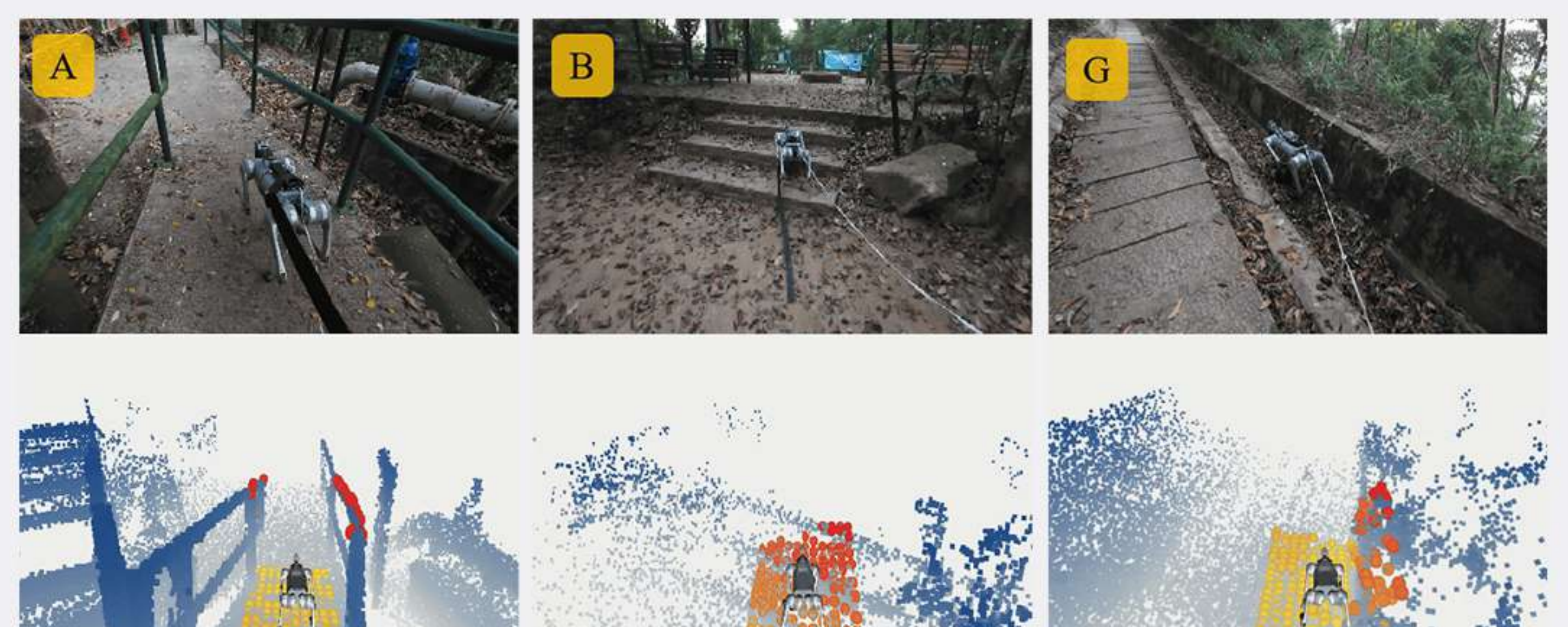
Methodology



Field Deployment and Outdoor Validation



Beyond structured indoor setups, we deploy the system in outdoor hiking environments and visualize traversable support regions from onboard LiDAR observations.



The proposed system converts single-LiDAR observations into a robot-centered elevation map and combines terrain features with proprioception in a learned locomotion policy to generate stable actions over risky gap terrains.