Designing semi-autonomous networks of miniature robots for inspection of bridges and other large infrastructures

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Description

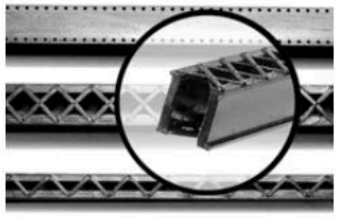
Create semi-autonomous robotic systems for inspection of large infrastructures.

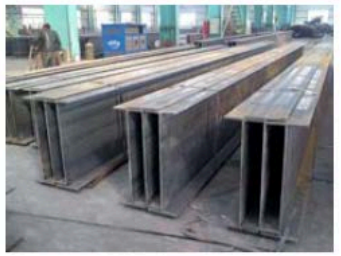
US has 607,380 bridges, of which 65,605 are "structurally deficient."

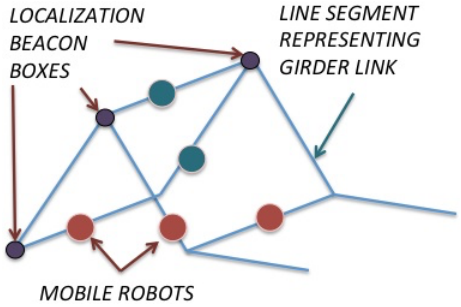
Main challenges:

- Mobility and communication. (Hardware)
- Coordination among and with semi-autonomous assets. (Theory and algorithms)
- Allocation of human inspection tasks. (Theory and algorithms)

Collaborator: MD State Highway Administration



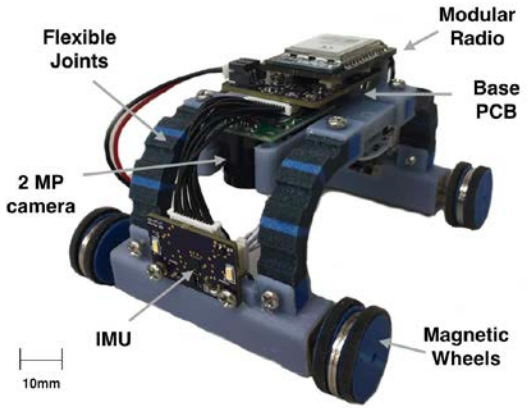




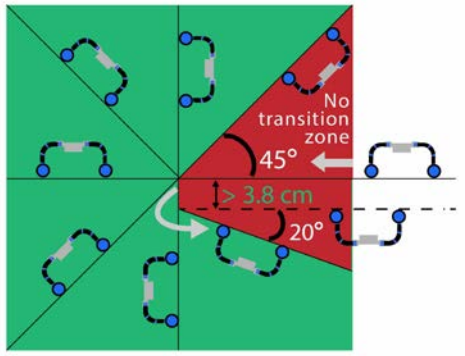
(a) Bending of a metal plate that was detected prior to the collapse.

(b) Fracture that was later found to be a major cause of the collapse.

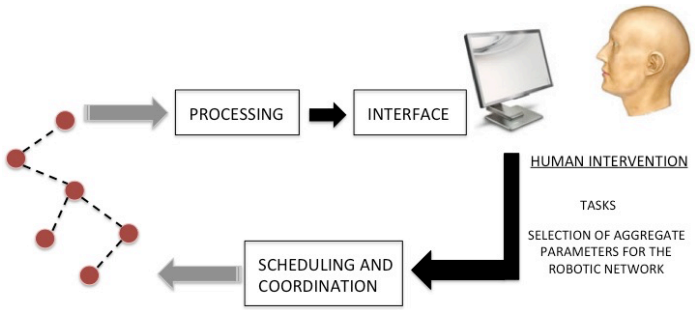
Findings



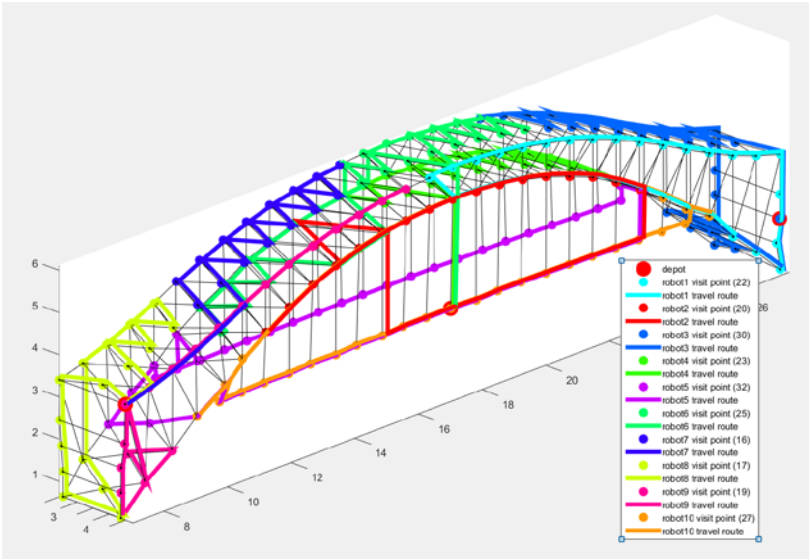
Magnetic robotic bridge explorer capable of navigating through sharp transitions and complex girders.
(prototype functional)



Algorithms and theory for scheduling subject to workload considerations.



Algorithms with complexity analysis for path planning subject to battery charging.



Non-magnetic climbing:
Electrostatic and vacuum.
(preliminary)