Fault-tolerance in Priority Evacuation and Mutual Visibility of Mobile Robots – SERB

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Motivation: Initially, robots are inspired to be designed based on humans, but now many developers are modeling robots after small insects and other animals. Instead of a sophisticated robot, using a multi-robot system to perform complex tasks efficiently is the new trend.

A collection of identical robots is called a swarm of robots. The inspiration behind designing such robots are insects like ants, which behave collectively. The individual robot in these systems is very cheap compared to a sophisticated robot. The system provides easy scalability. Each of them has the same capability and hence somewhat resilient to malfunction of one robot, where another can cover for it.

These systems are deployable in hostile environments where human intervention is not possible without the need for recovery. The robots are expected to complete the assigned task, even if a few of them become faulty. The cooperative behavior of these multi-robot systems has gained significant interest over the past two decades.

Fault-tolerance Priority Evacuation of Mobile Robots – Given a set of slave robots (low priority) with a Queen robot (high priority). The objective is to minimize the time required for evacuation of the Queen from a disk of unit radius via an exit hidden on the perimeter where one or more slave robots are susceptible to faults (unable to move).

Fault-tolerance Mutual Visibility of Mobile Robots - A set of mobile robots are placed in the Euclidean plane, each at a distinct arbitrary point. The goal is they relocate themselves to reach a configuration such that they can see each other in the presence of fault robots. Fault means robots are unable to relocate and/or unable to change light color for communication.

Highlights and Results:

❖ **For priority evacuation problem**, we establish a lower bound of the problem and design a distributed algorithm to solve it for circle. Work in progress for different convex shapes, lines or rays for the search domain with multiple high priority robots which are also susceptible to crash fault.

❖ Chauffeuring in the case of priority evacuation is the innovation of this work.

❖ **For mutual visibility problem,** we design a distributed algorithm to achieve mutual visibility with the proscriptive of non-faulty robots in a fully-synchronized context under one-axis agreement without lights, where all faulty and non-faulty robots are initially located in a line.
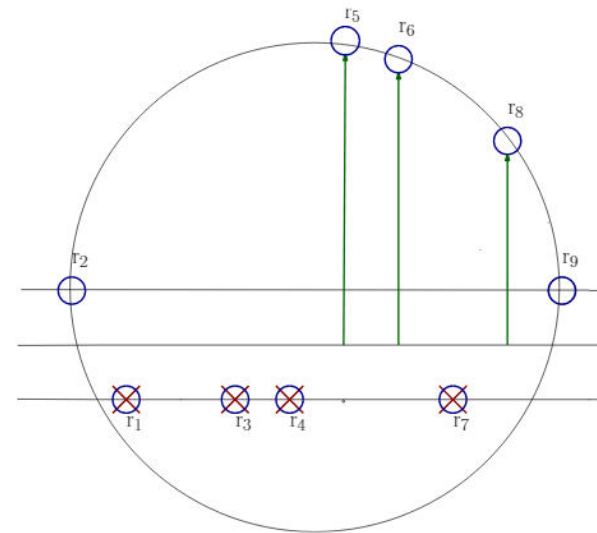

Fig. 3.4. In Round 3, remaining non faulty robots r_5, r_6, r_8 move in positive y-direction to reach the semicircle perimeter formed by r_2 and r_9. This is the final configuration of robots.