2015 ICRA Workshop
Robotics & Automation Technologies for Humanitarian Applications: Where we are & Where we can be

2015 RAS-SIGHT Humanitarian Robotics and Automation Technology Challenge (HRATC)

TEAM ORION

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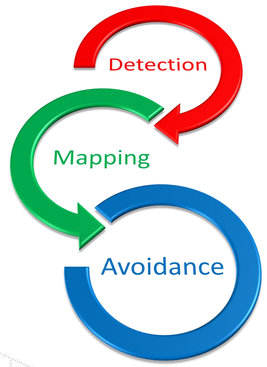
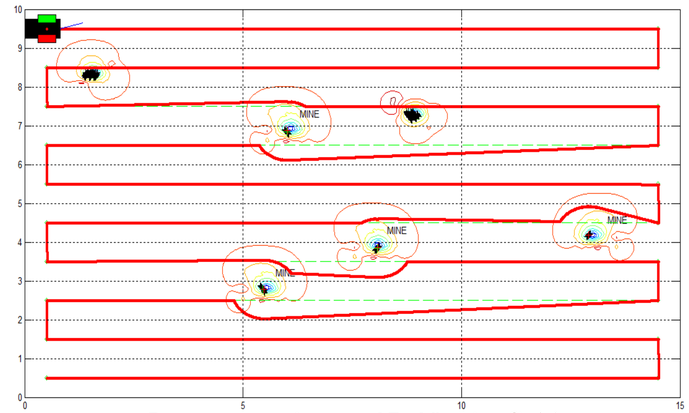
Methodology

1. Metal/Surrogate-Mine location is considered Gaussian Distribution Functions to be estimated from signal readings using nonlinear optimization methods.
2. Support Vector Machine radial basis classification algorithm is used for Surrogate-Mine and Metal categorization.
3. Detected mines are added into the global map as obstacles, and robot navigation is achieved via the ROS stack.
4. Minefield coverage is carried out using spiral navigation taking into account the minefield corners.

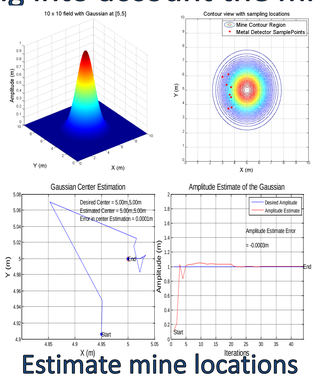




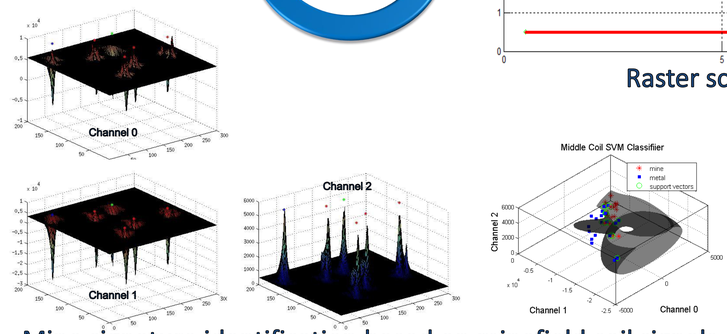
Raster scanning on 15x10 minefield

Progress Beyond State of the Art

1. Integrated adaptive sampling nonlinear optimization methods to estimate mine center locations.
2. Proposed high accuracy mine signature identification based on Support Vector Machine classifier.



Estimate mine locations

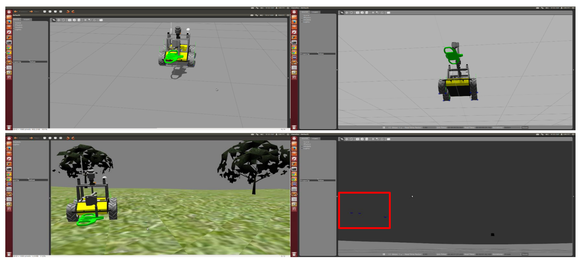


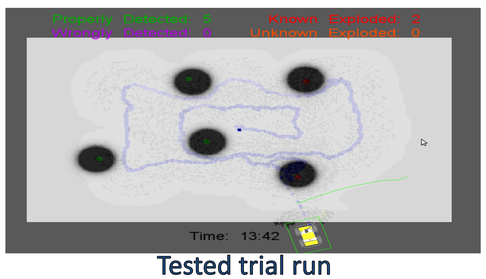
Mine signature identification based on minefield coil signals

Results

Simulation

1. The detection strategy accurately classifies mines in vicinity of detector.
2. High number of unknown mines are still triggered due to lack of detector coverage area and optimum environment exploration.
3. Challenges in navigation and mine avoidance due to physics and contact challenges in simulator as seen in tested trial run below.

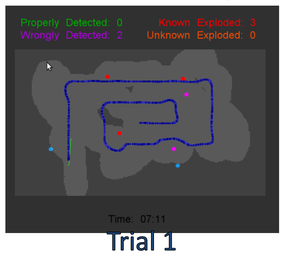




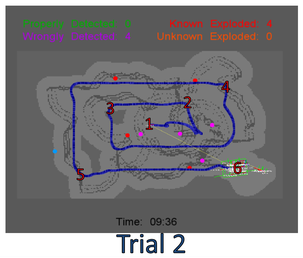
Tested trial run

Testing

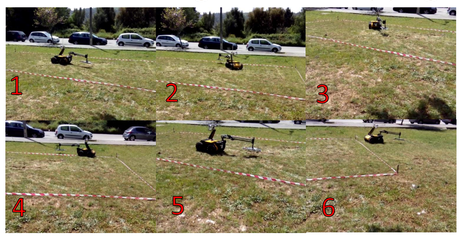
1. More test data is necessary to extract meaningful conclusions.
2. Sweep node needs to be robust to collect data over the next sampling locations on detections.
3. Challenges in mine or metal identification, minefield frame estimation with the actual robot.
4. Challenges in mine avoidance and field coverage due to slippage.

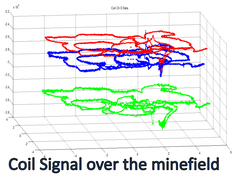


Trial 1



Trial 2





Coil Signal over the minefield