



# **Odour Source Localization Using Multiple Plume-Tracing Mobile Robots**

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## STATEMENT OF ORIGINALITY

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## ABSTRACT

The recent increasing threat of chemical weapons technologies has highlighted the need for superior detection of hazardous emission sources. One promising area of technological development is odour source detection using plume-tracing mobile robots, which have the potential to detect emissions released by sources such as fire, toxic gas and explosives, without endangering human life during the detection process.

Aims of this proposed research project are to investigate the use of multiple mobile robots to locate a dangerous odour source in realistic environments. The realistic environments presented in this study are two city-like environments and a complicated indoor building environment. These two kinds of environments are considered to have a very close relationship with human life.

The research methods for this project include two aspects which are simulation and experimental validation. A simulation framework for this study was constructed using combined CFD and MATLAB techniques. The control strategies for plume-tracing mobile robots were developed and tested in the simulation framework.

A prototype plume-tracing mobile robot was physically developed for the purpose of real world experimental validation. A series of experiments proved that the control strategies developed in the simulation framework was applicable to a real plume-tracing robot; on the other hand, the experiments also proved that the developed simulation framework was capable of reflecting real world plume-tracing scenarios.

The contributions to the plume-tracing research field achieved in this research project are: (a) a novel simulation framework using combined CFD and MATLAB techniques for plume tracing research was developed and it is believed that the framework is helpful for the researchers in plume-tracing research field; (b) a small size plume-tracing mobile robot was fabricated. This small robot has the capability of tracing odour plumes in complicated wind-varying environments. The capability of this kind of robot is considered to be a new input into this research field. (c) a supervisory approach was proposed in this study and the developed supervisory programs coordinated multiple robots to locate an odour source in realistic environments effectively.

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