Generic fault-detection for multirobot systems

Results in Brief

Novel fault-detection technology for environmental monitoring by robot teams

Fault detection and fault tolerance are two major challenges in large-scale multi-robot systems known as robot swarms, particularly in environmental science. An EU initiative has introduced a novel system for environmental monitoring scenarios.

DIGITAL ECONOMY

FUNDAMENTAL RESEARCH

© Farbentek, Shutterstock

In many real-world settings, robot swarms need to accurately and timely detect and accommodate robots that behave abnormally. This is especially relevant in environmental monitoring, where an undetected faulty robot may interfere with and possibly damage the very system being monitored.

The EU-funded GIFTED-MRS (Generic fault-detection for multirobot systems) project built a system that can adapt to temporal variations in a robot's behaviour and environmental perturbations.

Project partners developed a generic fault-detection system for robot swarms. The swarms are able to monitor themselves and indicate the occurrence of faulty robots. They demonstrated how robots with limited and imperfect sensing capabilities can observe and classify the behaviour of one another. To achieve this, they used an algorithm that learns to distinguish between normal and abnormal behaviour online.

Through a series of experiments, scientists systematically assessed the performance of the proposed approach for a large swarm of robots. They analysed the system's capacity to correctly detect robots with faults, the time required to detect a fault since it first occurred in the robot, and the false alarm rate.

Results show that the system is robust and able to detect faults in a timely manner. Specifically, fault detection occurs within 3 minutes for more than 90 % of the tested conditions. The innovation also achieves a low false alarm rate of under 2 %.

The GIFTED-MRS technology has the potential to assist in long-term autonomous operation with minimal human intervention. As a result, this should increase the usefulness of robots for a broad range of future applications in distributed intelligent automation, such as environmental monitoring and agriculture automation. Another potential application area is for multi-robot systems operating in the healthcare sector.

Keywords

Fault detection, environmental monitoring, multi-robot systems, robot swarms, GIFTED-MRS

Project Information

GIFTED-MRS

Grant agreement ID: 623620

Project closed

Start date
1 March 2015

End date
28 February 2017

Funded under
Specific programme "People" implementing the Seventh Framework Programme of the European Community for research, technological development and demonstration activities (2007 to 2013)

Total cost
€ 221 606,40

EU contribution
€ 221 606,40

Coordinated by
UNIVERSITY OF YORK
United Kingdom

Last update: 25 October 2017