



The European Coordination Hub for Open Robotics Development

4th Review Meeting – WP5

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PDTI - SIAR Consortium**

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Background / motivation



Sewer Inspection Autonomous Robot

Consortium

IDMind (IDM), PT
Universidad de Sevilla (USE), ES
Universidad Pablo de Olavide (UPO), ES

Main Roles

IDM (Coord.) - Platform development and
Commercial exploitation

USE - Perception and communications

UPO - Navigation

SIAR Goals

- robust IP67 robot frame designed to work in the hardest environmental conditions;
- increased power autonomy and flexible inspection capabilities;
- robust and increased communication capabilities;
- increased onboard autonomous navigation and inspection capabilities;
- usability and cost effectiveness of the developed solution.

Developed Solution

Locomotion Platform

- six-wheeled differential kinematic configuration with an axle track width adjustment mechanism
- The axle track mechanism increases the adaptability of the robot to the sewer configuration
- Main features:
 - Weight: 55 Kg
 - Payload capability: 30 Kg
 - Battery autonomy: up to 4 hours
 - Maximum Velocity: 0.75 m/s
 - Height x Max_Width x Length : 44 x 70 x 84 cm
 - Height x Min_Width x Length : 44 x 50 x 98 cm

Communications

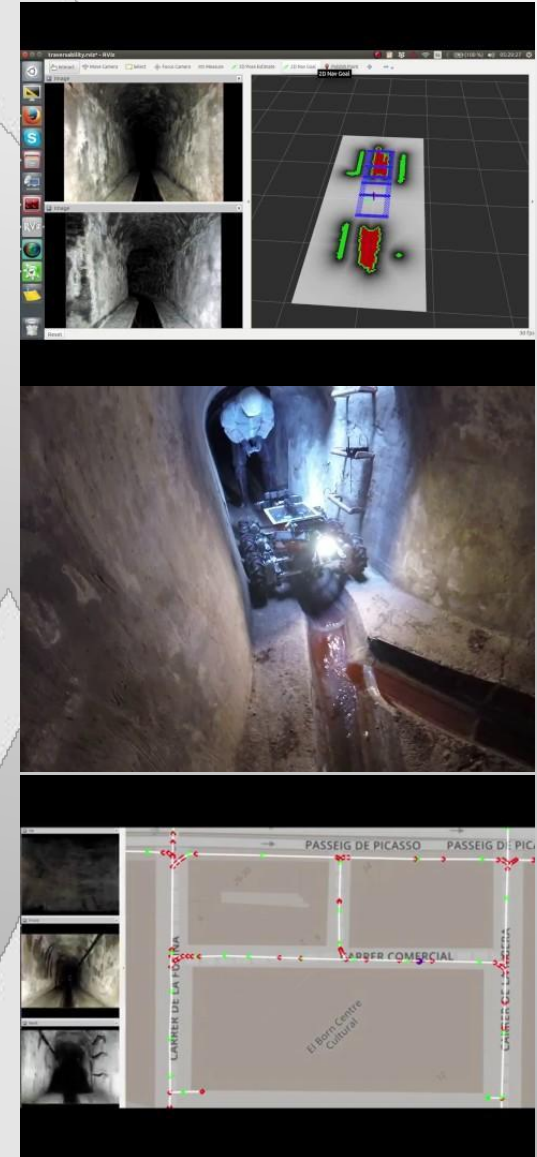
- deploying self-powered wireless repeaters
- high bandwidth connection used for robot commanding, video streaming and additional information such as 3D



Developed Solution

Navigation

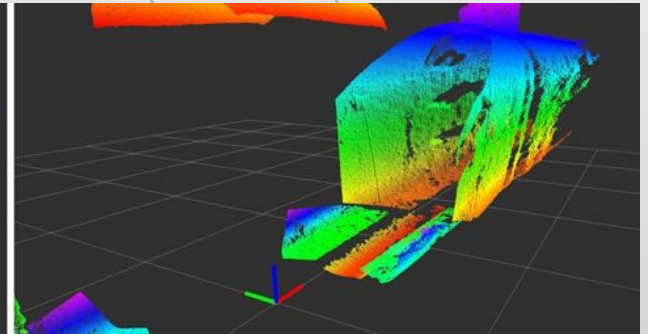
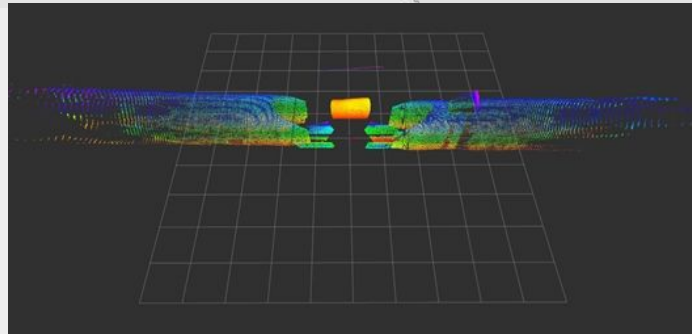
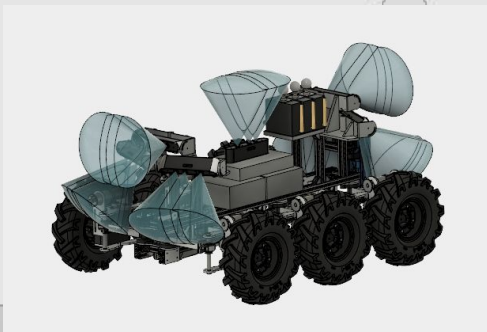
- strategy: let the robot solving the navigation so that the operator can focus in the inspection task
- array RGB-D sensors provides fully environment awareness => automatically navigate through the center of the sewer
- system is able to traverse the gutter when need, i. e., whenever a fork is found; the operator is allowed to choose the new direction to follow
- fusion of onboard sensors and given prior geometric information of the structure of the sewer => self-localization in real-time with an absolute error below 1m



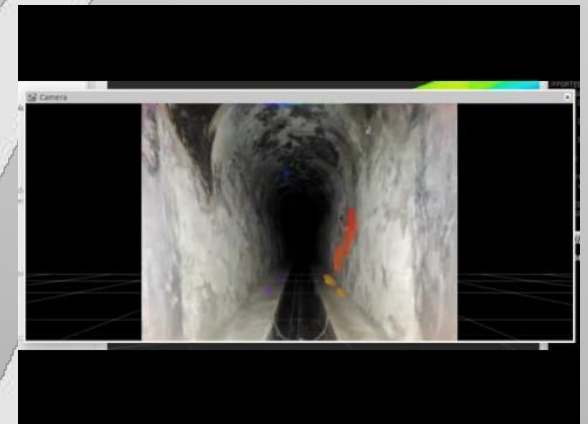
Developed Solution

Perception

- 7 RGB-D camera sensors enable metric 3D scanning of the environment



- automatically detect inlets, manholes or structural defects on the sewers, given prior information about the section of the sewer gallery



Being part of PDTI in ECHORD++

Benefit from participation in ECHORD++

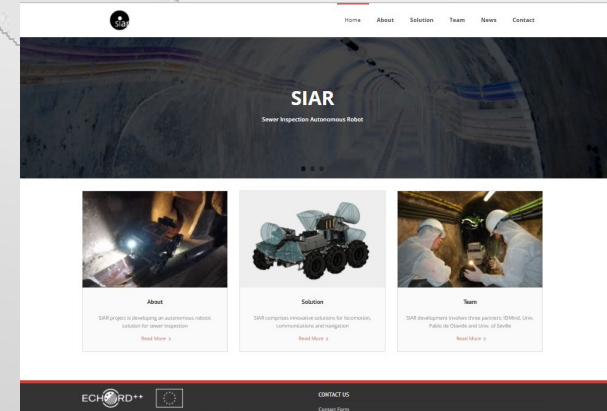
- Addressing end user needs
- Application driven R&D
- Collaborative work at an operational level
- Dissemination opportunities in important events
- Support from the ECHORD core team

Development Process

- multi-stage, iterative development process, with permanent dialog with evaluators and end-users, has a positive impact on the outcomes.

Actionable Insights

- How to simplify the amendment process?...



SIAR website: siar.idmind.pt



SMART CITY 2017

Impact of Work Conducted

What will you have to show for it?

- Generating some good contacts and business opportunities either directly related to the inspection scenario of the project or to the use of its technologies in other scenarios of operation
 - BCASA (PDTI end user)
 - local companies/services of sewer management in Seville and Lisbon
 - Conlima (ES)
 - Aquafin (BE)
 - Anglian Water Services Limited (UK)
 - Gas Natural Fenosa (ES)

What has the support allowed you to achieve

- Develop a close to market solution (TRL 7)

How does the outcome fit with your development strategy

- Remote inspection is one of the strategic markets of the company. The interest in autonomous robotic solutions for inspection and maintenance is growing rapidly throughout different industries. In short term, IDM expects to start making business from SIAR based solutions.

Outlook

Next steps: PDTI Phase III

- Refinement of the locomotion platform;
- Integration of environmental sensing systems;
- Improvement of the radio repeater for easy installation on manholes;
- Improvement of the robot localization and mapping framework;
- Improvement of the sewer inspection software for automatic detection of structural defects and serviceability;
- Extension of the semi-autonomous navigation system to better negotiate forks;
- Development of a base control station with improved usability.
- Define SIAR's market and exploitation strategies.

Longer term perspectives and growth expectations

- Exploit the SIAR solution
- Improve the market position (remote inspection)

Thank you

Questions?

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Sewer Inspection autonomous robot