Autonomous System for Use in UK Nuclear Environments

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Problem

- The use of **Artificial Intelligence** in the **nuclear** industry is currently limited due to the inability to demonstrate that it is **safe** for specific operations.
- In the **UK**, the **nuclear regulatory regime** requires a safety claim to be argued and substantiated for any operation.
- Existing techniques for assuring the behaviour of **Robotic Autonomous Systems (RAS)**, are not robust enough for use in nuclear environments.

Definitions

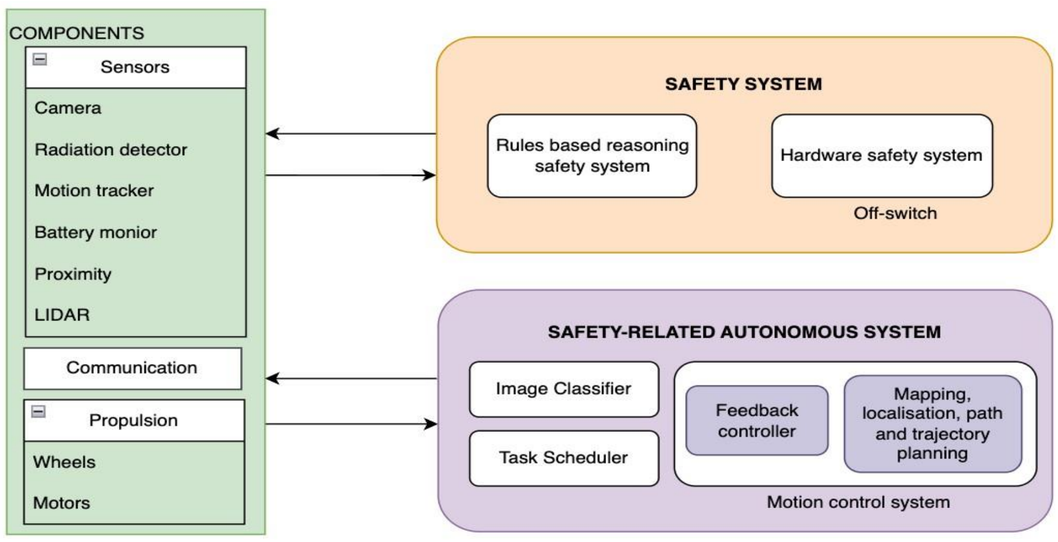
Safety System: Involves multiple components working together to ensure safe operations in hazardous conditions. They are crucial for safeguarding both the robot, operators, and the general public. [1]

Safety Instrumented Function (SIF): Designed to achieve and maintain a safe state for a process or system in the presence of hazardous conditions.

Proposed Solution

The proposed architecture incorporates:

- A traditional control system: **safety-related autonomous system**.
- A **safety system** which implements the SIF, offering independent oversight with strong guarantees for safety requirements.

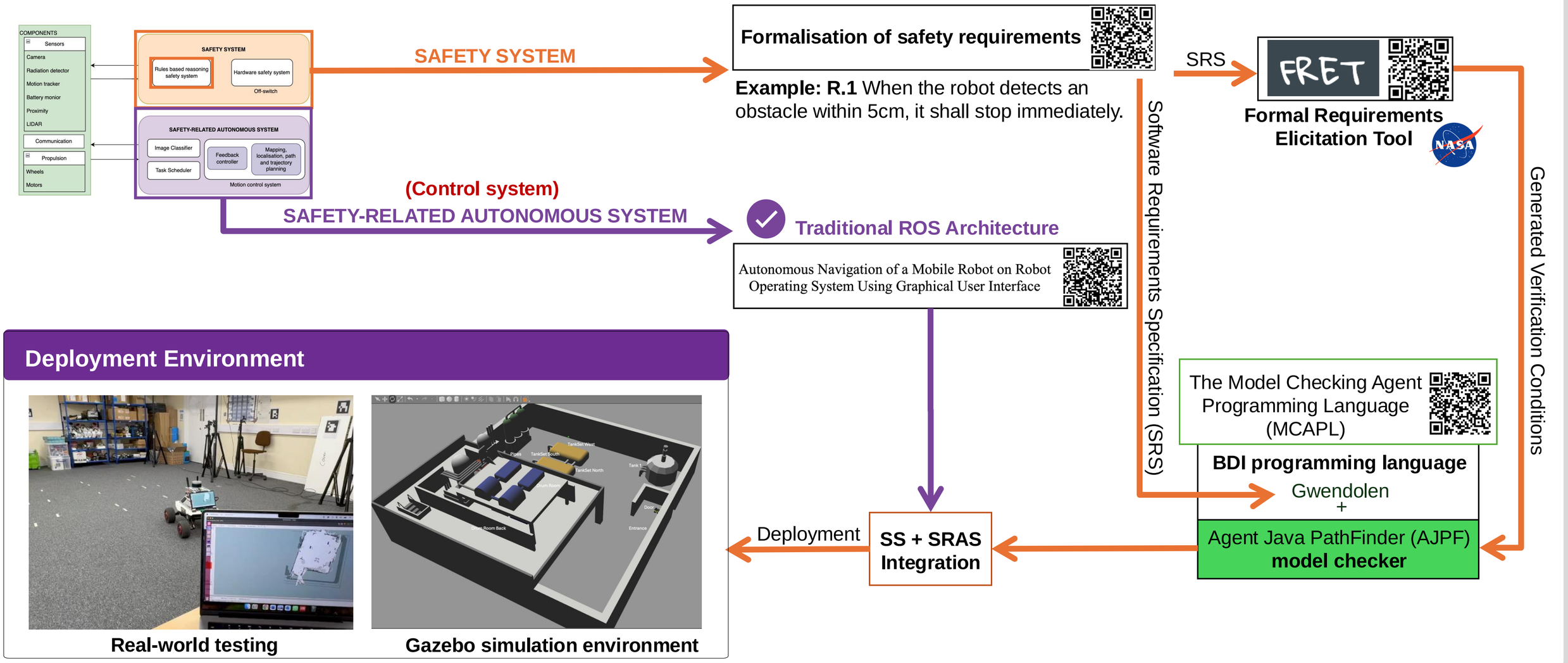


This work extends a previously proposed method [3]. When safety properties are at risk of violation, a rule-based SIF intervenes, bringing the robot to a safe state and maintaining it.

Regulation/Assurance Considerations

- Safety systems must be physically separate and independent, with sufficient redundancy and segregation to maintain reliability. [2]
- Robust verification methods and testing are crucial to ensure predictable and safe robot behaviour. [4]

Methodology



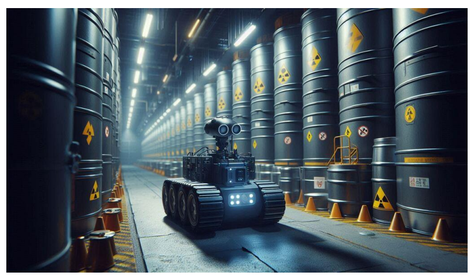
Deployment Environment

Real-world testing

Gazebo simulation environment

Use Cases

- Self-diagnosis and Condition Monitoring
- Inspection and Exploration
- Waste Consignment
- Manipulation Based Tasks
- Sort and Segregation



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