

Smart Museum

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Abstract

The emergence of smart technologies has revolutionised various sectors, including cultural institutions like museums. This abstract presents a comprehensive overview of a project, “Smart Museum”, which employs sensor-based systems, robotics, and IoT technologies. This in turn enhances security by offering remote access, alarm systems, and behaviour monitoring within a museum setting. The importance of this project lies in its innovative approach to addressing critical challenges faced by museums, such as security tightening and streamlining visitor navigation. By leveraging advanced technologies, the Smart Museum system aims to improve operational efficiency and enrich the overall visitor experience, thereby contributing to the evolution of museum management practices.

The Smart Museum endeavours to tackle multifaceted challenges inherent to museum management. Security vulnerabilities and visitor navigation complexities are of the highest significance and therefore should be handled systematically in real-time. This introduces the integration of sensor-based systems and robotics, further enabling real-time data analysis for informed decision-making. Utilising a combination of MQTT protocol, OpenHAB platform including rrd4j Persistence, and various sensors such as door sensors, motion sensors, buttons, and plug switches, the Smart Museum implements a robust infrastructure for seamless communication and control. Additionally, the project employs a Turtlebot robot equipped with navigation capabilities to facilitate dynamic and efficient movement within the museum environment.

This implementation yields promising results in enhancing security surveillance, optimising visitor navigation and providing valuable insights through data analytics. By effectively integrating sensor data from the rrd4j database along with the HABPanel GUI, interoperability between devices is clearly demonstrated. The project enables museum staff to monitor and manage the museum space efficiently while ensuring a smooth and engaging experience for visitors, by utilising several functionalities. Namely, button and UI control of a security robot (Turtlebot) to navigate to multiple rooms; security door sensors and persistence to keep an entry count; motion sensing in high security rooms to trigger a silent alarm and the security bot, which captures precise images; and colour detection by the security bot when searching for the nearest charging station. This work significantly contributes to the body of knowledge on IoT applications in public buildings and their security-oriented systems. The findings and methodologies presented in this project have definite practical implications for future research and the development of smart technologies in museums and the sector in which they lie, as well as a vast range of other use cases such as industrial or residential spaces.

Keywords— Smart Museum, Sensor-based system, Robotics, IoT (Internet of Things), Real-time, MQTT (Message, Queuing Telemetry Transport), OpenHAB, rrd4j Persistence, GUI (Graphical User Interface), Interoperability

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