Title: Design of Reconfigurable Drain Inspection Robots

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Design of Reconfigurable Drain Inspection Robots: The extensiveness in research, design explorations and development work for automating the process of remote drain inspection using robots are the uniqueness and contribution from this research work. Stringent operational requirements from research and deployment perspective incorporates important considerations such as drain type (C shape drain, S shape drain, Flat drain and V drains), terrain type (concrete, soggy, granular sands, water accumulation), design demands (weight, compactness, transportation, numbers, user experience), functional requirements (sample collection, disinfectant disposal{solid drop, liquid spray} and AI enabled detection capabilities {trash, structure defects, water contamination}). Incorporating all these requirements, the design exploration stage produced over 30 prototypes and 4 variants of robots. The prototypes are manufactured and tested for (1) Stable maneuverability (locomotion enabled using limbs, wheels and tracks), (2) Reconfigurability (height, width and length), (2) Mapping accuracy (Odometry dependent and Only scan matching dependent), (3) Localization (indoor outdoor methods - UWB, Lidar based , GPS) (4) Navigation ((Fuzzy logic based wall-following, local and global Path planning) (5) Processing (onboard and cloud processing). The system implemented is a fleet of 15 edge AI enabled reconfigurable robots operated under IoRT framework capable of autonomous maneuvering and mapping in unknown drains while generating a fused map with colour coded defects for stress free inspection and maintenance. The system originated from in-detail research publishing (in process) over 10 research articles and real field implementation in Singapore drains.

Biography

Povendhan Palanismay has completed his Master's at the age of 22 years from KTH University, Sweden specializing in Engineering Design and works as Sr.Researcher at ROAR Lab, SUTD while pursuing his second masters in Innovation by Design. He is a Full scholarship awardee both for his Masters (from SUTD University) and for the Singapore government initiative program AI for Industry. He has published (some under publishing) more than 12 papers in reputed journals (including IROS and Nature Scientific report) and has Industry experience from GKN ePowetrain in Sweden, Schwing Stetter in Germany, WAM Groups in Italy and Caterpillar from India. His area of research includes sensor fusion, deep convolutional neural network, edge AI and autonomous systems and reinforcement learning.

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