Robotic Steam Boiler Tube Cleaning & Inspection System

The COVID-19 pandemic brings unprecedented public health challenges to Hong Kong. Surgical tools and healthcare linen touch healthcare staff and patients directly or indirectly on a daily basis, and they undergo disinfection and steam sterilization process to kill bacteria, viruses and microorganisms before their use for medical procedures. The heart of the sterilization process is the steam boiler system which operates around the clock and supplies steam to meet the increased sterilizing and catering needs of the healthcare industry.

To uphold the performance of the steam boiler, regular cleaning of fire tubes is necessary to remove deposits build-up thereby enhancing heat transfer and reducing fuel consumption as well as preventing metal surface from corrosion. The existing cleaning procedure involves considerable manual handling operations potentially leading to repetitive muscle strain injury and dust inhalation. In addition, the health condition of the fire tube could not be validated readily.

This project aims to develop an innovative technology to automate the cleaning and inspection of steam boilers' fire tubes. It will automate the manual tasks using collaborative robotic arm, pneumatic cleaning brush, remote field testing probe and computer vision & A.I. pattern recognition for positioning and health assessment with a view to achieving predictive maintenance.

This novel system will present the results in graphical format while endoscopic images facilitate further health assessment. Not only does it enhance the boiler reliability and efficiency, but also improves the occupational health and safety. Other than the medical sector, the system can be widely adopted in hotel and garment industry, and its application can be further extended to air-conditioning chiller plant.