

Research project and supervisory team

Supervisory Team	Lee, Boon Giin Matthew Pike Qian Zhang Liang Huang
Short introduction & description of research project	<p>Firefighting is an inherently dangerous occupation. Current technologies used by firefighters could be considered primitive, when compared to the technological advancements we've witnessed in other fields of work. In this research, we will design and develop a smart firefighting operations system (SFOS) for use in real firefighting situations. The SFOS will utilize data from several sensors embedded into a firefighter's Personal Protective Equipment (PPE) and other firefighting equipment. Using wireless communications networks, data from these sensors and equipment will be integrated and processed using intelligent algorithms. These algorithms will produce a dynamic safety and risk assessment of the fire scene, enabling firefighters to obtain a better sense of the dangers and potential route for traversing the fire scene. SFOS will also enable the modelling of the indoor environment using non-vision-based localization and mapping techniques, which allow firefighters to 'see through the smoke'. Through the realization of SFOS, we hope to improve the occupational health and safety of firefighters through better coordination and communication between firefighting teams.</p> <p>The key research themes for this project are:</p> <ul style="list-style-type: none"> • Intelligent environment inspection using Robotics and IoT. Firegrounds are dangerous environments. This work will explore the application of autonomous drones and crawling robots to evaluate the environment for factors relevant to the rescue mission e.g., Hazards, survivors, fire sources, etc. Data obtained from multiple robots will be used to produce an environment risk assessment using a deep learning-based approach. Similarly, this work will require the scheduling and optimized routing of several robots throughout the environment. Image processing techniques will also be used to identify relevant objects and properties of the fire scene. • IoT-based Communication Systems for firefighter communications. This work will focus on developing the framework necessary for transmitting wireless data from inside the fire-ground to the outside. In addition to developing the necessary communications capabilities, we will also develop intelligent interference removal techniques for improving the quality of transmitted data. • Augmented Reality (AR) for information visualization in firefighting contexts. Here, we will explore the impact of presenting mission-critical information such as firefighter's physiological state, indoor

	<p>mapping, equipment status and environmental factors to firefighters during a rescue mission.</p> <p>Candidates should have experience in conducting basic research in at least one of the following subject areas: computer vision, hardware design (PCB design), wireless communication technologies, AR / VR / MR technology (Unity, ARCore, Viro), health analytics, indoor localization and mapping and other related fields. Ideally candidates will be graduates from Computer Science, Electronic and Electrical Engineering or Robotics programmes.</p>
Contact points	Boon Giin Lee (boon-giin.lee@nottingham.edu.cn)