Target localisation by a Robot in a cluttered environment

Autonomous systems that can locate the source of a chemical or acoustic emitter are highly desirable in emergency-response operations. It is a challenging task to develop such systems that function efficiently in noisy environments, which is a challenging task. In this work, we will implement bearing-only tracking (BOT) algorithm to estimate the location of a target emitting bright light using an unmanned ground vehicle (UGV), carrying a sensor array constructed from photodiodes. This BOT algorithm uses Bayesian recursive equations, and updates the posterior of all the possible locations at each time. These algorithms are robust to noisy observations and thus minimise false estimations of the target position.

Our sequential Bayesian estimation algorithms are implemented using simple and noisy sensors. Our sensor model is binary, where each sensor generates one bit of information. Binary sensors are gaining wider acceptance due to their low data bandwidth, which further leads to low power consumption during transmission of information. These properties have allowed building large sensor networks for various Internet of Things (IoT) applications. As these networks get bigger, such simple and noisy binary sensors enable more data to be collected to make ever more intelligent decisions. Moreover, such sensors provide a cost-effective solution due to their low costs. We envisage that the work started in this report will pioneer the development of generic hardware for target localisation applications using imperfect binary sensors. In this work, first the BOT algorithm will be implemented on generic digital hardware (such as FPGA) and later it will be ported to a Neuromorphic array processor such as IFAT (Integrate and Fire Array Transceiver).