

# Cooperative positioning for emergency responders using self IMU and peer-to-peer radios measurements

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## Abstract

Positioning between multiple users without any given infrastructure is essential for many applications, such as emergency response in disaster areas. Traditional approaches based on inertial-measurement units (IMU) are able to measure position changes without any reference, but the accuracy deteriorates due to error accumulation for long terms. Particularly, it is challenging to deal with irregular walking patterns of users. This paper proposes to combine IMU and radio measurements (i.e., peer-to-peer Wifi received signal strength and peer-to-peer UWB ranging) for the positioning of a group of mobile users in emergency response, where no fixed anchors and no infrastructure are available. We incorporate the IMU and radio measurements into the particle filtering, which has the capability to cooperatively position a group of mobile users and recover from any potential tracking failures. By fusing the long-range Wifi RSS and short-range UWB ranging measurements, we can take the advantages of both sensors and achieve an accurate and robust positioning system. We have conducted experiments to validate the proposed approach both in a simulation and a real world experiment. Our experimental results show that the combination of Wifi and UWB measurements provides a positioning accuracy of 2.6 m, which is an improvement of 26% and 10% as compared with Wifi (3.5 m) and UWB (2.9 m) alone.