Life READER: REmote Airborne DEtection of Respiration

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In post-disaster situations, the initial goal is to rescue survivors and effective triage is key to increasing survival rates. Unmanned Aerial Vehicles (UAVs), commonly referred to as drones, can safely operate in areas which remain unsafe for traditional human search and rescue due to hazards such as rubble or biological, chemical, or radioactive contamination. However, most UAV search and rescue procedures rely on optical image processing which cannot accurately measure human vital signs through darkness, smoke, and clothing, which are common in post-disaster environments. Radar-based motion sensors are not subject to these limitations, and can potentially be used on a UAV to detect respiration motion to assess casualties. Radar, however, will also sense the motion of the UAV as interference. To address this, an independent measurement of drone motion is used as an input for an adaptive filter which suppresses the interference from the radar measurement. For this project, this scenario was modeled with robotic movers simulating breathing and UAV motion. The filter was designed and demonstrated to accurately reproduce computer-simulated sinusoidal breathing displacement motion, even when the drone was subjected to motion of up to twenty times greater displacement. In a physical experiment, the filter extracted the frequency of motion for a robotic breathing simulator with an accuracy of 98%. The results indicate that this dual-radar drone method should be viable for remote measurement of breathing for subjects in hazardous environments.

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