Technology Opportunity, Ref. No. UB-24/176

High resolution 3-D echolocation in challenging environments

Keywords	3-D sensing, Time-of-Flight, Time-of-Arrival, Echolocation
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Reference	“3-D Sonic Phase-invariant Echolocation”, ICRA 2023, London
Background	In the field of echolocation, beamforming and phased-arrays are often considered state-of-the-art methods. Phased-arrays generally comprise a large number of transducers with position constraints to steer a beam of sound waves in a specific direction. This technology has been widely used in applications such as radar and sonar systems. However, requirements on the transducer number and positions can be a limiting factor for phased-arrays, and there has been interest in trading off these needs for computational efforts while maintaining comparable performance.
Invention	To address these challenges, Parallax among Corresponding Echoes (PaCE) is introduced as a depth-sensing hybrid that incorporates triangulation and time-of-flight concepts at a geometric level. PaCE uses active time-of-flight triangulation for 3-D localization without phase information, sensor position constraints and the need for tags or beacons. The novel 3-D localization model consists of an intersection of ellipsoid bodies spanned by at least 3 corresponding echoes from different detectors. The echo correspondence is accomplished by feeding similarity features into Multi-Layer Perceptrons (MLPs).

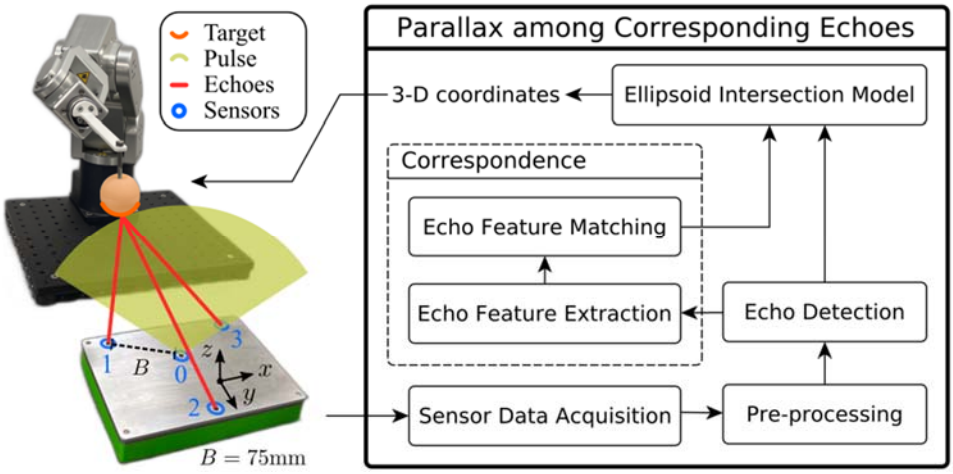

Fig: The prototype (upper left) consists of 1 emitter and 3 detectors capturing echoes whose correspondence (lower right) is solved for ellipsoid intersection (upper right) to yield valid 3-D coordinates (lower left).

Application	Filling-level metering, drone navigation, vehicle sensing, medical robotics, warehouse measurements/logistics,
Patent Status	Priority Patent Application filed

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