

Table 1. Current location sensing technologies.

Technology	Technique	Physical	Symbolic	Absolute	Relative	LLC	Recognition	Accuracy and precision if available	Scale	Cost	Limitations
GPS	Radio time-of-flight lateration	•		•		✓		1-5 meters (95-99 percent)	24 satellites worldwide	Expensive infrastructure \$100 receivers	Not indoors
Active Badges	Diffuse infrared cellular proximity		•	•			✓	Room size	1 base per room, badge per base per 10 sec	Administration costs, cheap tags and bases	Sunlight and fluorescent light interfere with infrared
Active Bats	Ultrasound time-of-flight lateration	•		•			✓	9 cm (95 percent)	1 base per 10 square meters, 25 computations per room per sec	Administration costs, cheap tags and sensors	Required ceiling sensor grid
MotionStar	Scene analysis, lateration	•		•			✓	1 mm, 1 ms, 0.1° (nearly 100 percent)	Controller per scene, 108 sensors per scene	Controlled scenes, expensive hardware	Control unit tether, precise installation
VHF Omini-directional Ranging	Angulation	•		•		✓		1° radial (≈ 100 percent)	Several transmitters per metropolitan area	Expensive infrastructure, inexpensive aircraft receivers	30-140 nautical miles, line of sight
Cricket	Proximity, lateration		•	◦	◦	✓		4 × 4 ft. regions (≈ 100 percent)	≈ 1 beacon per 16 square ft.	\$10 beacons and receivers	No central management receiver computation
MSR RADAR	802.11 RF scene analysis and triangulation	•		•			✓	3-4.3 m (50 percent)	3 bases per floor	802.11 network installation, ≈ \$100 wireless NICs	Wireless NICs required
PinPoint 3D-iD	RF lateration	•		•			✓	1-3 m	Several bases per building	Infrastructure installation, expensive hardware	Proprietary, 802.11 interference
Avalanche Transceivers	Radio signal strength proximity	•			•			Variable, 60-80 meter range	1 transceiver per person	≈ \$200 per transceiver	Short radio range, unwanted signal attenuation
Easy Living	Vision, triangulation		•	•			✓	Variable	3 cameras per small room	Processing power, installation cameras	Ubiquitous public cameras
Smart Floor	Physical contact proximity	•		•			✓	Spacing of pressure sensors (100 percent)	Complete sensor grid per floor	Installation of sensor grid, creation of footfall training dataset	Recognition may not scale to large populations
Automatic ID systems	Proximity		•	◦	◦		✓	Range of sensing phenomenon (RFID typically <1m)	Sensor per location	Installation, variable hardware costs	Must know sensor locations
Wireless Andrew	802.11 proximity		•	•			✓	802.11 cell size, (≈ approx. 100 m indoor, 1 km free space)	Many bases per campus	802.11 deployment, ≈ \$100 wireless NICs	Wireless NICs required, RF cell geometries
E911	Triangulation	•		•			✓	150-300 m (95 percent)	Density of cellular infrastructure	Upgrading phone hardware or cell infrastructure	Only where cell coverage exists
SpotON	Ad hoc lateration	•			•		✓	Depends on cluster size	Cluster at least 2 tags	\$30 per tag, no infrastructure	Attenuation less accurate than time-of-flight