

Characteristics of Tracking Technology

1) Physical Phenomenon - Measurements can exploit electromagnetic radiation (including visible light, infrared light, laser light, radio signals, and magnetic flux), sound, physical linkage, gravity, and inertia. Specialized sensors are available for each of these physical phenomena.

2) Measurement Principle- We can measure signal strength, signal direction, and time of flight (both absolute time and phase of a periodic signal). Note that time-of-flight measurements require some form of secondary communication channel to confirm clock synchronization between sender and receiver. Moreover, we can measure electromechanical properties.

3) Sensor Arrangement - A common approach is to use multiple sensors together in a known rigid geometric configuration, such as a stereo camera rig. Such a configuration can either be sparse, if only a few sensors are used, or in the form of a dense 2D array, such as a digital camera sensor with millions of pixels.

4) Signal Sources - Sources provide the signal that is picked up by the sensors. Like sensors, sources must be positioned in a known geometric configuration. Sources can be either passive or active.

- Passive sources rely on natural signals present in the environment, such as natural light or the Earth's magnetic field. When no external source is apparent, such as in inertial sensing, the signaling method is described as source less sensing.

- Active sources rely on some form of electronics to produce a physical signal.

5) Degrees of Freedom - In measuring systems, a degree of freedom (DOF) is an independent dimension of measurement. Registering real and virtual objects in three-dimensional space usually requires determining the pose of objects with six degrees of freedom (6DOF).

6) Measurement Error - Real-world sensors are subject to both systematic and random measurement errors. Systematic measurement error, such as a static offset, a scale factor error, or a systematic deviation from ideal measurements because of predictable or measurable influences of the environment can be addressed by improved calibration efforts.

7) Temporal Characteristics - There are two important temporal characteristics of tracking systems: update rate and latency. The update rate (or temporal resolution) is the number of measurements performed per given time interval. Latency is the time it takes from the occurrence of a physical event, such as a motion, to a corresponding data record becoming available to the AR application.