УДК 621.391
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WIRELESS INDOOR POSITIONING TECHNOLOGIES

Modern consumer and industrial applications often require indoor positioning systems. Manufacturers use them in robots, such as consumer vacuum robots, to track personnel and packages at industrial sites. There are several existing non-radio positioning technologies such as magnetic positioning, tracking based on inertial measurements, and visual markers or visual features. However, they often need an additional radio module for each tracking tag. Because these technologies calculate position using the tracker's computing capabilities, a Wireless Local Area Network (WLAN) must also be available to help them to transmit computed data. These principles may be implemented directly in consumer mobile phones. They must be tailored specifically for a chosen area and often require costly equipment to increase accuracy:

1. For magnetic positioning, a magnetic fingerprint of the steel building structures has to be recorded and analyzed. [1]

2. Positioning based on inertial measurements requires an inertial measurement unit (IMU) that provides low observational error. When using low-

quality IMU, a measurement error is quickly accumulated and has to be mitigated using reference points. [2]

3. Visual positioning methods require studying the area for known visual features, as well as preparing appropriate neural networks and other algorithms for efficient feature recognition. [3]

Radio positioning technologies usually win over non-radio ones because most of them offer data transfer over the same network that is utilized for positioning. This removes additional costs for infrastructure needed to transmit position data. We divide popular radio positioning technologies into two categories: short-range and long-range.

Short-range systems usually determine position using available nearby anchor points with a known position. They do not track an exact location, but rather proximity to an anchor and are perfect for geo-fencing. This approach has low hardware requirements and complexity. It may be perfect for museum guide tours and determining booth locations at expositions. Anchor devices within these systems usually use Wi-Fi, Bluetooth or Near Field Communication radio modules with omnidirectional short-range antennas. Positioning error may be decreased by decreasing anchors' transmission power and increasing their density per square meter. Such systems require the installation of a large number of anchors across the building, which may not be ideal in some cases [4-5].

The long-range positioning technologies are the most desirable ones. They offer exact positioning within the 4-meter margin of error or less. The most notable advantage is the reduced number of anchor devices necessary to install within the tracking area. Anchors, however, have increased hardware and software complexity compared to the short-range technologies.

Therefore, to develop the system using wireless indoor positioning technologies it is necessary to combine several technologies. This approach helps to ensure required accuracy and reliability.

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