LOCATION MANAGEMENT FOR MOBILE CELLULAR SYSTEMS

TYPES OF LOCATION UPDATE ALGORITHMS

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- **Time based -** Time-based algorithms use the timestamp of the last location update to estimate the current location of a mobile device. The idea behind time-based algorithms is that a mobile device is likely to be in the same location for a certain period, so if the timestamp of the last location update is recent, the device is likely still in the same location.

    1. **First-order hold**: The first-order hold algorithm assumes that the mobile device moves at a constant velocity between location updates.
    2. **Kalman filtering**: The algorithm uses a mathematical model of the mobile device's motion and measurement data to estimate its current location and it uses the timestamp of the last location update and sensor data from the mobile device, such as its speed, direction, and acceleration, to estimate its current location.
    3. **Linear interpolation**: The algorithm uses the timestamp of the last location update and the speed and direction of the mobile device to estimate its current location.

- **Movement based -** Movement-based algorithms use information about the movement of a mobile device, such as its speed and direction, to estimate its current location. These algorithms are particularly useful in situations where a mobile device is moving quickly, making it difficult to estimate its location accurately using time-based or other techniques.

    1. **Map-matching**: The algorithm that matches the movement of a mobile device to a pre-existing map of the area by using sensor data from the mobile device, such as its speed and direction, to match the movement to the road network in the map and estimate its current location.
    2. **Dead reckoning**: The algorithm uses sensor data from the mobile device, such as its speed and direction, to estimate its current location, by keeping track of its previous location and movement.
    3. **Pedestrian dead reckoning**: The algorithm uses sensor data from the mobile device, such as its step count and orientation, to estimate its current location. Designed specifically for pedestrian navigation.

- **Distance based -** Distance-based algorithms use the distance between a mobile device and a nearby base station or other reference point to estimate its location. These algorithms are particularly useful in situations where the mobile device is stationary or moving slowly.

    1. **Fingerprinting**: The algorithm creates a map of the signal strength or time delay of the signals between the mobile device and nearby base stations or other reference points and then matches the signal map to a pre-existing map of the area to estimate the location of the mobile device.
    2. **Trilateration**: The algorithm uses the distance between a mobile device and three or more nearby base stations to estimate its location. It uses the time delay or signal strength of the signals between the mobile device and the base stations to calculate the distance. (Enhanced version of proximity algorithm which used a reference point to estimate the distance)

- **Blanket Paging -** Blanket paging is an effective technique for locating a mobile device when its location is unknown. However, it can also be resource-intensive, as it requires broadcasting the paging message to all base stations within the area or cell. As a result, blanket paging is typically used as a last resort when other location management techniques have failed to locate the mobile device.