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A Survey on Localization Methods in Intelligent Transportation System

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Abstract—Wireless Sensor Networks have been proposed for a multitude of location-dependent applications. For such networks, location is being used to identify the location at which sensor readings originate. In this paper, a survey of the localization methods in the wireless sensor networks is presented.The contribution of this survey is to give a classification of existing fingerprintbasedlocalizationapproacheswhichintelligentlysenseandmatch different clues from the environment to identify location.
Keywords—*Wireless sensor networks, Location, Fingerprinting based localization.*

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I. INTRODUCTION

An Intelligent Transportation System (ITS) is an important aspect to generate vehicular traffic information for wide region[6]. To identify traffic information, we have to know location of vehicles.A growing number of sensors on smart mobile devices has led to rapid development of various mobile applications using location-based services.Localization is a process to compute the location of the wireless devices in a network.Many localization algorithms for sensor networks have been proposed to provide per-node location information[1].

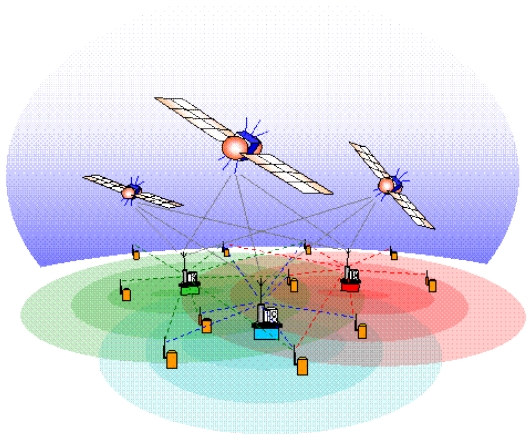

Fig.1 Localization Scenario

This article has following sections, Section IIdiscuss the literature survey of papers, Section III contains the overview of different types of localization methods, Section IV provides the different techniques of fingerprinting based localization. We conclude our work in last section V.

II. LITERATURE SURVEY

T. He, C. Huang, at al. in paper [1] from their extensive comparison study, identify preferable system configurations of four different range-free localization schemes as a design guideline for further research. They also conclude that an APIT scheme, proposed in paper, performs best when irregular radio patterns and random node placement are considered, and low communication overhead is desired. They conclude that range-free localization schemes are regarded as a cost-effective and sufficient solution for localization in sensor networks.

Sudhir Kumar, Rajesh M. Hegde in paper[2] give a comprehensive survey of the localization and tracking methods in the wireless sensor networks.They conclude that fingerprinting localization yields good accuracy at the expense of extensive offline training and the low-cost multi-sensor data fusion based localization provides good localization accuracy.

Jia, F., Cheng, X., Duan, Z. in paper[3] uses the statistical method to find the main activity areas of non-resident tourists and distribution of crowd in Shanghai during day time. They give a method to identify the Nonresident Tourists in Shanghai Expo and calculate the residence time of the base station. Their goal is to analyze the scope of this kind of relevant traffic demand.

D. Valerioat al.in paper[4] address the problem of using cellular network signaling for inferring real-time road traffic information.In active monitoring, the procedure used by the network to gather information about users' location and/or position generates additional signaling traffic.In contrast to active monitoring, with passive techniques signaling is silently

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collected from one or more points in the network with no impactin the offered network load. They survey active and passive monitoring techniques and gave the vision of a hybrid system.

Q. D. Vo and P. De in paper[5] describe how each fingerprinting technique works, followed by a review of the merits and demerits of the systems which is based on these techniques. They conclude by identifying several improvements and application domain for fingerprinting based localization.

III. LOCALIZATION METHODS

With regard to the mechanisms used for estimating location, localization protocols divided into two categories: range-based and range-free.

1. Range-based Localization

- **Time Of Arrival (TOA):**It's a method that tries to estimate distance between 2 nodes using time based measures. It is accurate but needs synchronization.Many radiolocation systems, including GPS, use TOA.

- **Time Difference Of Arrival (TDOA):** It is an electronic technique, in which the time of arrival of a specific signal, at physically separate receiving stations with precisely synchronized time references, are calculated. There is no need of synchronization in this technique but it is costly. One commercial application for TDOA is locating a cellular telephone based on comparing when the signal arrives at different cell towers.It is also used in passive radar systems.

- **Angle Of Arrival (AOA)**: It is a method for determining the direction of propagation of a radio frequency wave incident on an antenna array. AOA determines the direction by measuring the Time Difference of Arrival (TDOA) at individual elements of the array -- from these delays the AOA can be calculated. It is more precise method. It is Costly and needs extensive signal processing. A current application of AOA is in the geodesic location or geolocation of cell phones.AOA is generally used to discover the location of pirate radio stations or of any military radio transmitter. In submarineacoustics, AOA is the method to localize objects with active or passive ranging. In optics, AOA is considered from the perspective of interferometry.

- **Received signal strength indicator (RSSI)**: It is a measurement of the power present in received radiosignal. RSSI is usually invisible to a user of a receiving device. It is very sensitive to noise. In zero-IF systems, it is done in the baseband signal chain, before the baseband amplifier.

2. Range-free Localization

- **Approximate Point in Triangle(APIT):** Few sensor nodes that are equipped with high-powered transmitters are called anchors. The unknown node can obtain its location based on the information from the anchors. If there exists a direction of movement such that N is closer or further away to A1, A2, and A3 simultaneously, then N is outside of ΔA1A2A3. Otherwise, N is inside Δ A1A2A3. It isCost effective approach and provide good localization accuracy.

- **DV-HOP:** It doesn't need to measure the absolute distance between the beacon node and unknown node. It uses the average hop distance to approximate the actual distances and reduces the hardware requirements.It is based on the average hop distance between two sensor nodes. Easy to implement and applicable to large n/w. The positioning error is correspondingly increased. It Can make real time monitoring for position, inventory and shift info of the goods.

- **Amorphous:** It proposed independently from DV-Hop, uses a similar algorithm for estimating position. Each node obtains the hop distance to distributed anchors through beacon propagation.Once anchor estimates are collected, the hop distance estimation is obtained through local averaging. It Suffers from the high node densityrequirements for better accuracy. It is used to determine the location of unknown nodes.

- **Centroid:** It is a range-free,proximity-based, coarse grained localization algorithm, that uses anchor beacons, containing location information (Xi,Yi), to estimate node position. After receiving these beacons, a node estimates its location using the centroid formula. It is simple, easy of implementation method. Accuracy of the algorithm is based on higher density of the anchor nodes. It is useful in application like forest fires location detection, marine monitoring, animal monitoring.

- **Fingerprint-based:** It captures signatures that are matched against a set of geotagged signatures to identify a device location. Signatures can be recorded

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using different in-built sensors in a mobile device, or the sensors can be used intelligently to detect users' activity pattern.A fingerprint-based localization system typically comprises of two key modules; fingerprint sensing module and fingerprint matchingmodule. Steps for fingerprint based localization are shown in figure 2.

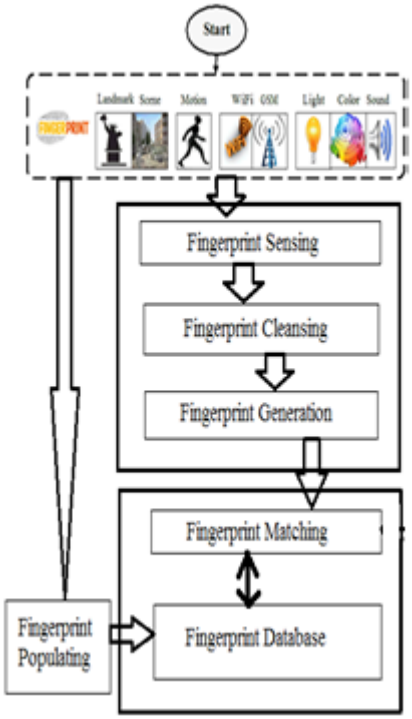

Fig. 2 Framework for Fingerprinting based localization

IV. Different Fingerprinting Based Localization Technique

Three main fingerprint types are visual fingerprint, motion fingerprint, and signal fingerprint. Finally, by combining multiple cues from different sensors it is possible to generate hybrid fingerprints.Different types of fingerprint based localization methods are described below.

A. **Visual Fingerprint:** Powerful image- and videoprocessing techniques equipped in modern mobile devices (smartphones or tablets) have enabled intensive research in visual-search techniques in the last decade. Many contentbased image retrieval techniques have been proposed to search a query image from a large image database using visual features appearing in images such as color, texture, shape. Along with these techniques, many mobile image-based retrieval applications have been introduced such as Google Goggles and Vuforia Object Scanner[5].

B. **Motion Fingerprint:** With the support of motion sensors such as accelerometers and electronic compasses or gyroscopes, today's smartphones can perform sensing and user motion recognition in real-time[5].

C. **Signal Fingerprint:** Several types of techniques that detect wireless signal for localization have been proposed such as signal fingerprinting, time of arrival (ToA), angle of arrival (AoA), time difference of arrival (TDoA). Among them, signal fingerprint-based localization techniques show higher accuracy in presence of complex radio wave propagations, compared to other techniques which often suffer from the effect of multipath signals in indoor environments. The basic idea of this technique is to find the location of a mobile device by comparing its signal pattern received from multiple transmitters (e.g. WiFi APs or BSs) with a predefined database of signal patterns[5].

D. **Hybrid Fingerprint:** There is a tradeoff between accuracy and power consumption in most of the techniques. However, combining multiple fingerprint types can lead to more robust hybrid fingerprint-based localization systems with better performance[5].

V. Conclusion

In this paper, we summarized all techniques that is relevant to the localization, we described it thoroughly with its advantages and disadvantages in its respective sections. Also we described the fingerprint based localization methods in a very prescribed manner.This survey would help the others who are keen interested towards the field of localization.

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References

[1]. T. He, C. Huang, B.M. Blum, J.A. Stankovic, and T. Abdelzaher, "Range-free localization schemes for large scale sensor networks,'' in *Proc. IEEE Mobicom* 2003 San Diego, California, Sept. 2003, pp. 81–95.

[2]. Sudhir Kumar, Rajesh M. Hegde, "A Review of Localization and Tracking Algorithms in Wireless Sensor Networks", in *ArXiv* 2017.

[3]. Jia, F., Cheng, X., Duan, Z.: 'Analyzing the activity areas of non-resident tourists of shanghai expo using cellular phone data', in *Procedia Soc. Behav. Sci.*, 2013, 96, pp. 1136–1145

[4]. D. Valerio, A. D'Alconzo, F. Ricciato, and W. Wiedermann, "Exploiting cellular networks for road traffic estimation: A survey and a research roadmap," in *IEEE VTC Spring*, 2009.

[5]. Q. D. Vo and P. De, ''A survey of fingerprint-based outdoor localization,'' in *IEEE Commun. Surveys Tut.*, vol. 18, no. 1, pp. 491–506, 1st Quart., 2015.

[6]. M. Chaturvedi and S. Srivastava, "Multi-modal design of an intelligent transportation system," Technical report available at http://goo.gl/HFX5iF, June 2016.