A review of RFID based solutions for indoor localization and location-based classification of tags

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Abstract: Wireless communication systems are very used for indoor localization of items. In particular, two main application field can be identified. The former relates to detection or localization of static items. The latter relates to real-time tracking of moving objects, whose movements can be reconstructed over identified timespans. Among the adopted technologies, Radio-Frequency IDentification (RFID), especially if based on cheap passive RFID tags, stands out for its affordability and reasonable efficiency. This aspect makes RFID suitable for both the above-mentioned applications, especially when a large number of objects need to be tagged. The reason lies in a suitable trade-off between low cost for implementing the position sensing system, and its precision and accuracy. However, RFID-based solutions suffer for limited reading range and lower accuracy. Solutions have been proposed by academia and industry. However, a structured analysis of developed solutions, useful for further implementations, is missing. The purpose of this paper is to highlight and review the recently proposed solutions for indoor localization making use of RFID passive tags. The paper focuses on both precise and qualitative location of objects. The form relates to (i) the correct position of tags, namely mapping their right position in a 2D or 3D environment. The latter relates to the classification of tags, namely the identification of the area where the tag is regardless its specific position.

Keywords: RFID, localization systems; positioning systems; location-based classification; RTLS

1. Introduction to localization problem

The increasing availability of information, due to the growing potentialities and the increasingly popular adoption of wireless technologies, resulted in a high demand for localization systems in both outdoor and indoor environments (Hightower and Borriello, 2001; Pahlavan, Li and Makela, 2002; Huang *et al.*, 2014). The request of information has become even more true because of the Internet of Things (Yao and Hsia, 2018). Several applications have been developed to provide services in many sectors including manufacturing, logistics, and operations management, as well as welfare optimization and daily life services, e.g., localization of assets in hospitals (Farid, Nordin and Ismail, 2013). As a result, both research and commercial solutions for developing these systems have been proposed, and in the last 25 years localization systems have become very popular to the extent that a new branch of contributions in automation research field has been defined, namely the object location detection (Liu *et al.*, 2007), which has further spread under the IoT era, of course (Li, Mo and Zhang, 2019). The reason for the interest in these systems lies in the fact that further accuracy estimating positions and power consumption efficiency are increasingly demanded (Yao and Hsia, 2018).

This branch of contribution relates to obtaining location information of objects, and different names have been used for labelling it and relative systems developed. Yunhao and Zheng (2011) refers to 'location-based services' and Farid *et al.* (2013) to 'location finding'. Other terms used in literature are 'position location', 'geolocation', 'location sensing', or generally localization (Liu *et al.*, 2007). In the rest of the paper, 'localization' is used as an umbrella term for generally identifying the process of estimating the position of objects.

This literature review proposes an analysis on the use of RFID technologies for indoor localization problems. RFID is an auto identification, consolidated, technology for the identification of assets, security, and track-and-trace applications (Ngai *et al.*, 2008). The set is mainly composed by a reader that drives the communication, and tags that have an associated electronic code for being uniquely identified (Landaluce *et al.*, 2020). The reader interrogates these tags using radio frequency (RF) signals, and the tags respond with their identification code (ID). Tags can be active (powered by a battery) or passive (harvesting the energy from the reader's RF signal). The focus of the study is on RFID technology since RFID, especially passive RFID UHF, is the most adopted technology in industrial environments because of the good trade-off between costs to implement the system, and precision of localization and unique identification of objects (Wu *et al.*, 2019). However other technologies can be used concurrently, e.g., GPS, WLAN, Bluetooth, NFC, Bluetooth, ZigBee technologies, and other Wireless Sensor Network technologies (Li, Mo and Zhang, 2019; Seferagić *et al.*, 2020). The combination of technologies and methods constitutes the localization system. The review proposed in this paper aims at discussing localization systems developed in terms of technologies and methods adopted for indoor localization. In the next, we refer to 'methods' as algorithms and techniques used for location estimation based on acquired signals, while 'technologies' relate to RFID sets (i.e., passive or active, and LF or HF or UHF tags), and other wireless communication technologies used in combination for acquiring the transmitted signal.

The reminder of the paper is organized as follows. In section 2, the perimeter of the research is fixed fixing the indoor localization problem by defining characteristics of different localization systems. In section 3, techniques and methods mainly adopted for developing indoor localization systems are provided. In section 4, the unstructured research methodology is introduced, and 18 documents retrieved are analysed, discussing typologies of indoor localization, technologies adopted, and methods developed. In section 5, results are discussed, and finally section 6 leads to conclusions.

2. Definition of the localization problem

There are many different types of localization, such as physical localization, symbolic localization, absolute localization, and relative localization (H. Liu *et al.*, 2007). Physical localization is expressed in the form of coordinates and identifies a point on a 2-D/3-D map by means of coordinate systems. Symbolic localization expresses a localization in a natural-language way, such as 'in the room', or 'on the shelf'. Absolute localization uses a shared reference grid for all located objects. A relative localization depends on its own frame of reference, and information is usually based on the proximity to known reference points or base stations.

The indoor localization can be of different nature. Although, based on the research carried out in this paper, the field seems not strictly distinguishing among different localization problems, two cases can be identified, and we stick to lexicon consistent with discussion of Farid *et al.* (2013). The former relates to items to be localized that are static. We refer to this configuration as 'location estimation'. The latter relates to moving items. This area of expertise relates to the real-time tracking of objects.

Concerning the difference between outdoor localization and indoor localization, the outdoor real-time tracking relates to general real-time locating systems (RTLS) (Curran *et al.*, 2011), while the indoor real-time localization relates to positioning systems (Rácz-Szabó *et al.*, 2020). Indoor positioning can be defined as any system that provides a precise position of items inside of a closed structure (Zhang *et al.*, 2010.

The field of expertise can be further organized distinguishing localization typologies according to Bergeron *et al.* (2018), and hence precise localization is different from qualitative estimates of position, and this stresses the needs for relative position of objects especially for qualitative applications. As a result of the analysis so far, the localization problem has been structured as in Figure 1.

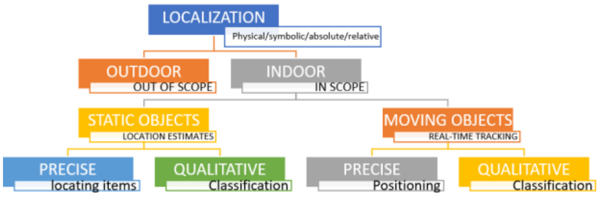

Figure 1: hierarchy of localization problems

3. Techniques and Methods

Farid *et al.* (2013) and Liu *et al.* (2007) reviewed three main categories of localization techniques, namely (i) proximity, (ii) triangulation, and (iii) scene analysis. The following sticks to these authors.

Proximity detection provides symbolic relative location information. The position of a mobile client is determined by cell of origin method with known position and limited range (Hu, Cheng and Zhang, 2011). Usually, it relies upon a dense grid of antennas, each having a well-known position, and attributing the position estimates on the basis of the acquired signal strength.

Triangulation uses the geometric properties of triangles to determine the target location. It has two derivations: lateration and angulation. Lateration techniques are based on the measurement of the propagation-time system, e.g., Time Of Arrival (TOA), Time Difference Of Arrival (TDOA), Round-Trip Of Flight (RTOF), and especially RSS-based and received signal phase (RSP) (Vossiek *et al.*, 2003; Seco *et al.*, 2009). These are distance-based techniques. On the contrary, angulation techniques also called estimation techniques, which are direction-based, are based on the Angle Of Arrival (AOA) that determines the angle of arrival of the mobile signal coming from a known location at which it is received at multiple base stations (Liu *et al.*, 2007).

Finally, scene analysis techniques estimate known current position based on last determined position and incrementing that position based on known or estimated speeds over elapsed time. In this case, new positions are calculated entirely from previous positions. RF-based scene analysis refers to the type of algorithms that first collect features (fingerprints) of a scene and then estimate the location of an object by matching measurements with the closest a-priori location fingerprints. Research has been carried out in indoor localization (House *et al.*, 2011; Pai *et al.*, 2012) using dead reckoning process.

While traditional outdoor localization relies on the triangulation and trilateration, such schemes do not work well indoors with obstacles and room partitions since both require line-of-Sight measurement (Liu *et al.*, 2007). Whatever the methods, the localization consists in a three-stage algorithm (Brena *et al.*, 2017). First stage concerns measurement of characteristics of a signal acquired. The second stage concerns the 'range estimation', where devices use the measurements or evidence obtained to estimate distance to/from the objects to be located. The third stage concerns the combination of such range estimates in order to calculate the position of the objects. This combination could be carried out using various technique, e.g., optimization methods (Munoz *et al.*, 2009) or matrix equation methods (Sayed, Tarighat and Khajehnouri, 2005; Vargas-Rosales *et al.*, 2015).

Several applications have been developed in industrial engineering, in the field of (i) business intelligence models for operations optimization (Fantoni *et al.*, 2020), (ii) building information modelling for facility management (Bellagente *et al.*, 2018; De Cillis *et al.*, 2020), and (iii) FMCG (Bottani *et al.*, 2009; Wölbitsch *et al.* 2020).

4. Materials collected

In this review, we started from relevant works of Bouet and Dos Santos (2008), Sanpechuda and Kovavisaruch (2008), and Zhou and Shi (2009) since they are noteworthy literature reviews discussing indoor positioning systems covering a timespan until 2009.

Sanpechuda and Kovavisaruch (2008) limited their analysis to indoor localization, because of more efficient implementation of the system and reliability of the infrastructure. They distinguish between reader localization and tag localization. Since the focus of the present paper on tagged objects, we stuck to the localization of tags.

Generally, all the studies analysed build the environment using reference tags. Techniques adopted are lateration but also other methods such as Bayesian approach lying in the posterior probability of movement of objects. One of the most important system is the LANDMARC (Ni *et al.*, 2003) This technique places reference tags in known location as landmarks to the system. The signal intensity of the reference tags is used to calibrate the uncertainty of the distance for tracking tags. The distance calibration is performed by weighing summation of the K-Nearest reference tags location, which relate to fingerprinting techniques. The highest weight is assigned to the reference tag with smallest signal intensity. Usually, LANDMARC deploys active tags as reference tags since they can provide information about the signal strength to detect the range of tracking tags. One of the main limits of LANDMARC is the use of a large amount of reference tags that increase the cost and require high computational power.

Same localization algorithms have been reviewed also by Zhou and Shi (2009), who in addition discuss the use in different industries and sectors of proximity detection and Kernel-based Learning methods, which obey the rule that the smaller the distance between two nodes in signal space is, the closer they are in the physical space, and localize objects accordingly.

Bouet and Dos Santos (2008) analysed three localization systems. First family relates to 'Distance estimation algorithms', that uses properties of triangles to estimate the target's location using RSSI, TOA, TDOA, and RSP. Second relates to 'Scene analysis' algorithms, lying in RSS and fingerprinting techniques. Finally, the 'Proximity' technique.

For more information on these works, we suggest the reader of referring to the original papers.

Starting from these noteworthy studies, we identified 12 keywords for querying the Scopus database, given by combination of the following terms: 'indoor localization' and 'indoor positioning', 'localization algorithm / system' and 'positioning algorithm / system', 'accuracy', 'wireless (sensor) network', and 'RFID' and 'Radio Frequency Identification' (or 'Radiofrequency identification') of course. By combining these keywords according to suitable Boolean operators (e.g., Radio Frequency Identification OR RFID), we retrieved 1,072 documents from 2010 to 2020 (documents published in 2021 were neglected for not biasing the review with partial results). Then we skimmed the list according to the following inclusion criteria: (i) indexed documents with just partial information or language different from English were not considered; (ii) the same applied to documents not accessible on the web; (iii) at least one document per year has been considered, for an evaluation of the evolution of the research; (iv) when multiple documents were present for one year, the selection of the document to be reviewed was up to the authors of this paper, on the basis of their feeling about the contents At the end of the process, a list of 17 papers was set, and these are discussed in the next section.

4.1 Localization systems using RFID technologies

Before the last 10 years, research on localization using RFID technologies, especially for indoor positioning, was focused on using active RFID tags, that are characterized by (i) high implementation costs and (ii) short life cycles (Yao and Hsia, 2018). Therefore, the interest of research has been focused on using commercial products of passive technology (i.e., both reader and tags), already complying with reliable standards such as EPC Global Class-1 Gen2 and developing localization algorithms to determine the target coordinates in centimetres (Yao and Hsia, 2018). Two main information have been used, the RSS and the phase of the received signal (Martinelli, 2015; Ma and Wang, 2017). The increasing efficiency of RFID localization systems has hence attracted increasing attention in industrial practices (Dobrev *et al.*, 2017).

Saab and Nakad (2010) developed a mathematical model for indoor positioning. Localization system relates to distance and position errors of RFID tag using instantaneous RSSI measurements received from the tags in the area, embedding an angle-dependent loss factor. The localization system uses a Kalman filter for the estimate of the RFID reader position.

Ni, Zhang, and Souryal (2011) presented an overview of RFID-based localization both indoor and outdoor. Solutions are both tag-based and reader-based, transceiver-free, and hybrid approaches. The paper is of value since authors also identified challenges to face still current (e.g., interferences due to the use of RSSI signals for localization), and possible solutions overcoming each type of challenge (for more information, refer to the authors).

Brchan *et al.* (2012) presented a RSSI-based RTLS using active RFID technology. Reference tags and multiple propagation models are proposed and used to improve the performance of RSSI based ranging. Authors point out that this model uses fewer reference tags than the LANDMARC system.

Yang *et al.* (2012) worked on RFID passive tag distribution, firstly defining a measure for accuracy and precision in a passive RFID localization system. The relationship between RFID tag distribution and positioning precision is then computed through an exponential-based function, and the localization precision is then correlated to density of RFID tag distribution adopting sparse tag distribution. The application of proposed sparse tag distribution strategy lies in the use of the localization algorithm of Park and Hashimoto (2009), which implies an effective rectangle-based feature selection method to filter RFID raw data.

Chawla *et al.* (2013) presented an RFID passive system based on RSS decay model for RTLS in a 3D space.

Huang *et al.* (2014) proposed an indoor positioning system using active RFID technology based on Kalman-filter for drift removal and Heron-bilateration for location estimation. Kalman-filter instead of statistics methods and reference node. Heron-bilateration is deployed as landmark mapping instead of other methods such as proximity pattern matching, trilateration, and multilateration.

Kuo and Chang (2015) presented a learning algorithm which integrate (i) an optimization version of an artificial immune network (named Opt-aiNET) (Timmis and Edmonds, 2004) and (ii) an artificial immune system (AIS) (Hart and Timmis, 2008), with clone selection for backpropagation neural network (aiNBSB). The result is a learning feed-forward neural network that learns the relationship between RSSI values received and a picking cart qualitative-position based on formulated weights of the forecasting model.

Scherhäufl, Pichler and Stelzer (2015) introduced a 2-D localization system for indoor precise position of static and moving objects, using passive UHF RFID tags. The system is based on evaluation of backscattered transponder signals. Authors state that '*in contrast to a variety of common systems, where either the phase or the amplitude of the received transponder signal is evaluated, incorporating both parameters the method combines the advantages of both approaches*'. The developed algorithm does not rely on reference transponders and computationally can be basically reduced to matrix multiplication.

Wang *et al.* (2016) proposed an indoor positioning system based on RSSI signal, using Particle Swarm Optimization to optimize the weights and threshold of a back propagation neural network. Authors state that the systems provided '*better performance of PSO compared with some other heuristic method no matter in the accuracy, stability and convergence speed of the algorithm*'. In addition, to reduce the influence of the large noise and big data acquired, a Gaussian filter method is used to process the received RSSI values.

Xiao *et al.* (2017) focused on the use of 2 tags for each object and introduced phase pre-processing using Multipath Propagation Model and Phase Ambiguity Elimination. Furthermore, by applying first-order Taylor series expansions to the distance functions between 'naïve' RFID tag positions and each known physical antenna, the corresponding error is evaluated. The choice of adding one-more RFID tag to the object relates to a three-fold will of (i) providing rich freedom in RFID reader's antenna spacing and placement; (ii) supporting accurate calibration of the reader antenna location and spacing, and (iii) enabling fine-grained calculation on the orientation of the tags.

Gao *et al.* (2017) proposed an indoor RFID positioning system lying on a range-free algorithm named nonmetric multidimensional scaling (NMDS)-RFID(F), which combines NMDS algorithm and the fingerprinting localization algorithm, realizing a RFID multi-tag cooperative localization method in the indoor environment.

Zhou-guo, Fang and Yi (2017) used a K-Nearest Neighbor (KNN) algorithm to improve the LANDMARK system in indoor positioning systems. The proposed method rectifies the k nearest reference-tags computing the KNN algorithm k times to get each reference tag coordinate position, and overcoming limitations of indoor environments such as diffraction, reflection, multi-path, and non-line-of-sights.

Xu *et al.* (2017) proposed a method based on RSSI of UHF passive RFID signals, using KNN algorithm, a gaussian filter to reduce noise, and a Bayesian probability model for precise location estimation. Gaussian filter is used to filter abnormal RSS values and Bayesian estimation together with the K-Nearest Neighbor algorithm are used to improve positioning accuracy.

Ma *et al.* (2017) used Hyperbolic positioning optimization to overcome phase ambiguity and device diversity. The method consists in acquiring multiple hyperbola curves from different antennas, then combining the results. After that, a Polynomial Regression is modelled through Particle Swarm Optimization to filter out random phases.

Yao and Hsia (2018) built a dual-channel low-power passive RFID positioning system. The method uses the jitter variance of the received backscattered amplitude-shift keying signal, which is inverse-proportional to the jitter variance. Hence, the probabilistic positioning algorithm lies in measuring the jitter variance values corresponding to tags located at the grid coordinates for all readers, as inverse indicator of the signal strength, and then categorizing values into four levels of magnitude. Next, the level clustering tables and the probability for all readers are constructed.

Wu *et al.* (2019) proposed a two-step method for positioning static tags. First step is the construction of an Unwrapped Phase-Position Model, then the location is calculated using an ordinary nonlinear least squares algorithm. Authors state that '*the proposed method has a lower calculation burden compared with the grid-based methods*'.

Wölbitsch *et al.* (2020) developed an interesting system for expressing precise location of objects in a retail shop, based on prediction of distances from referenced tags based on Density-based Spatial Clustering of Applications with Noise (DBSCAN) and Dynamic Time Warping (DTW).

Table 1 recaps all the systems analysed, with emphasis on typology of localization system with respect to hierarchy in Figure 1, methods adopted or developed, and RFID and concurrent technology adopted. Moreover, the location typology is distinguished between 'qualitative' and 'precise' according to the hierarchy introduced in Figure 1.

5. Discussion of results

So far, it emerges that the RFID technology is mainly used in indoor environments for precise estimation of positions of moving objects (see Figure 2).

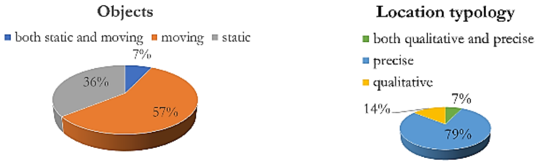

Figure 2: focus of RFID indoor localization systems

However, two things are not strictly related, namely precise localization of static objects is also analysed, as well as classification problems of both static and moving objects. Instead, it is possible to state that a good amount of research is focused on positioning of objects that move in environments with or without safety barriers, e.g., robot arms. On the contrary, if the interest of the early 2010’s research was on only moving objects, static applications have gradually gained interest, and logistics use cases have paved the way for adoption of relative systems. Concerning technologies adopted (see Figure 3), just a single study combines RFID with other technologies, namely Bluetooth, while all others use readers, tagged objects, and reference tags that constitute the landmarks of grid environments. UHF passive tags are the most used, and slightly more than half of the studies use the RSSI signal, while other studies criticize this signal and use either phase angle or both to mitigate the positioning error, since the accuracy of RSSI varies widely due to the tags’ orientation and antenna gain, which make RSSI not a reliable indicator for some positioning methods. Finally, innovative approaches have also been adopted, from different research fields, as statistics and artificial intelligence.

Table 1: classification of localization systems

Reference	Objects	Location typology	Signal	Method	Technologies
Saab and Nakad (2010)	moving	precise	RSSI	**Proximity / Triangulation:** instantaneous location method based on RSSI, using a **Kalman filter** to reduce the estimation error	RFID passive tags (labels) and off-the-shelf readers/antennas
Ni, Zhang, and Souryal (2011)	both static and moving	both qualitative and precise	RSSI	Localization via systems as LANDMARC (tag-based) or however based on reference tag (reader-based), data mining techniques for transceiver-free object tracking (transceiver-free technologies), LANDMARC or Support Vector Regression applied in a referenced grid area (hybrid technologies)	RFID active tags (for both tag-based and reader-based systems), beacons (for transceiver-free systems), and passive tags and Wireless Sensor Network (for indoor hybrid systems)
Brchan *et al.* (2012)	moving	both qualitative and precise	RSSI	**Proximity + Triangulation**: based on RSSI, first step detects the subarea (quadrant), then a propagation model is used to provide precise location, consisted with proximity elimination, range averages, and linear least squares (LSQ)	RFID active tags, and off-the-shelf readers and antennas (303MHz)
Yang *et al.* (2012)	moving	precise	-	**Proximity**: the reader is moved over a grid of passive tags and the position is estimated using a well-known localization algorithm. The main goal is to evaluate different grid patterns and densities	RFID passive tags (button tags), and off-the-shelf reader and antenna
Chawla *et al.* (2013)	moving	precise	RSSI	**Triangulation**: based on RSSI, uses an RSS decay model to establish the relationship between the tag’s RSS behavior and the tag-reader distance.	Wide selection of UHF RFID passive tags, Alien ALR-9900+ and ThingMagic Mercury6 readers
Huang *et al.* (2014)	moving	qualitative	RSSI	**Triangulation**: based on RSSI, uses Kalman filter (drift removal) to to solve the RSSI drift issue, then a Linear-Like RSSI-to-Distance Transformation, then Heron-bilateration (location estimation)	Active RFID tag (with bluetooth), Android device with RFID indoor positioning device (bluetooth)
Kuo and Chang (2015)	moving	qualitative	RSSI	Based on RSSI, uses **AIS** (artificial immune systems, a class of computationally intelligent systems inspired by the principles and processes of the vertebrate immune system) and **Opt-aiNET** (inspired by specific immunological theories that explain the function and behavior of the mammalian adaptive immune system)	OMRON V750-series UHF RFID System (tags and readers)
Scherhäufl, Pichler and Stelzer (2015)	static	precise	RSSI and phase/AOA	Localizaton model based on both **Phase-of-Arrival and Amplitude signals**	RFID passive tags (labels), and off-the-shelf readers and antennas
Wang *et al.* (2016)	static	precise	RSSI	Based on RSSI, uses **Particle Swarm Optimization** (PSO) to optimize the weights and threshold of a **back propagation neural network**	Laird-S8658WPL UHF RFID System (965 MHz) (passive tags and antennas)
Xiao *et al.* (2017)	both static and moving	precise	Distance between two readers	Focuses on the use of **2 tags for each object**, performs phase preprocessing (Multipath Propagation Model + Phase Ambiguity Elimination) and naïve localization	Impinj R420 RFID reader, Impinj H47 RFID passive Tag (label)
Gao *et al.* (2017)	static	precise	RSSI	**NMDS-RFID(F)** algorithm combines fingerprint localization and Nonmetric Multidimensional Scaling (NMDS)	Simulated environment
Zhou-guo, Fang and Yi (2017)	Moving	precise	RSSI	Uses a **KNN** to improve the LANDMARK system	-
Xu *et al.* (2017)	moving	precise	RSSI	Based on RSSI, uses **KNN**, a **gaussian filter** to reduce noise, and a **Bayesian estimation** (probability model)	Impinj R420 RFID reader, UHF passive tags
Ma *et al.* (2017)	static	precise	phase/AOA	Uses **Hyperbolic positioning optimization** to overcome phase ambiguity and device diversity acquires multiple hyperbola curves from different virtual antennas, then combines the results. After that, uses **Polynomial Regression** to filter out random phases	Commercial off-the-shelf readers and passive UHF tags
Yao and Hsia (2018)	moving	precise	TDSNR	Initial analysis: **Time-Domain Signal to Noise Ratio**, then categorization based on the **jitter variance**, then **probabilistic positioning algorithm**	Dual-channel passive RFID tags (915 MHz + 433 MHz), dual channel RFID reader
Wu *et al.* (2019)	static	precise	phase/AOA	First step is the construction of an **Unwrapped Phase-Position Model**, then the location is calculated using a **nonlinear least squares algorithm**	Impinj Speedway R420 (UHF), passive UHF tags
Wölbitsch *et al.* (2020)	static	precise	RSSI	Calculation of **probability** of distance on the basis of **DBSCAN** and **DTW**	UHF passive tags

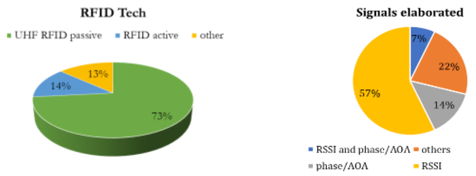

Figure 3: technologies and signals adopted

6. Conclusion

The present paper has provided a rather thorough review of indoor localization systems developed research. The paper has started from reliable and well-known systems, providing the basics of the branch of contributions on the topic. Then, it has moved into research produced in the last 10 years, analysing how the field has evolved, and what technologies and approaches has become 'stable'. However, the present paper has some limits.

Firstly, the review has not followed a rigorous tructured methodology. Although the goal was that of discussing the basics of the branch of contribution, and then providing an overview of the studies of the last ten years, the way in which material has been retrieved could affect the results. Secondly, related to the first limit, the number of documents reviewed is not so important to carry out a real in-depth analysis of the field. However, this aspect has considered partially affecting the validity of this paper, since the will of providing preliminary study from which develop more complete analyses. Consequently, a structured approach, considering diverse localization problems also in addition to those approached in this review, and considering a higher amount of research, needs to be carried out.

Authors are working on these issues.

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