[Indoor Global Localisation in Anchorbased Systems using Audio Signals]

In the approach presented in this paper, in which information concerning the anchor’s position travels through the channel embedded in the signal, successful data transmission is critical. Even if the MDP with respect to the anchors is precisely determined, if the anchor positions are wrong due to bad reception this will result in bad positioning, localisation estimation can be the wrong indoor infrastructure. Therefore, the data transmission problem must be assumed as one of the most important parts of this global localisation system. Therefore redundancy, error detection/correction and filtering techniques are employed to avoid significant errors. The Golay codeword has useful properties regarding its use in data transmission: . Cyclic Invariance. A 23-bit Golay codeword may be cyclically shifted by any number of bits and the result is also a valid Golay codeword; . Inversion. An inverted 23-bit Golay codeword is also a valid Golay codeword; . Minimum Hamming Distance. The Hamming distance between any two Golay [24,12] codewords is always eight or more bits; . Error Correction. The correction mechanism of Golay decoding can detect and correct up to three bit errors per codeword.

RANGE

Range measurements: The measurements aim to find the differences of the TOA of the signals from the transmitter to the three receivers whose locations are known. Each range difference determines a hyperbola, and the intersection point of the two hyperbolas is the estimated location of the querying node. For each receiver, the relative TOA is determined by applying correlation between the received signal and the template signal.

[An Ultrasonic Multiple-Access Ranging Core Based on Frequency Shift Keying Towards Indoor Localization]

Distance estimation requires time synchronization, a correlator peak detector and a timer module. Time synchronization enables the devices to have a common time reference between transmitter and receiver, which is used to estimate the time of travel of an ultrasonic signal. In our implementation, we choose to synchronize the devices by means of wires. The transmitter pulls the wire to a logic “1” while sending and to “0” when idle. The receiver synchronizes itself against the transition from “0” to “1”, and the correlator calculates the signal equality against a given orthogonal code. When the signal shows a strong correlation with the code, a correlation peak occurs. The time difference between the time synchronization and the correlation peak is proportional to the distance between transmitter and receiver. In order to keep track of this time difference, a module keeps track of the highest correlation peak time.

[CSI-Based Indoor Localization]

RSSI-based schemes have been widely used to provide location-aware services in WLAN. However, in this paper, we observe that RSSI is roughly measured and easily affected by the multipath effect which is unreliable. We then use the finegrained information, that is, CSI, which explores the frequency diversity characteristic in OFDM systems to build the indoor localization system FILA. In FILA, we process the CSI of multiple subcarriers in a single packet as effective CSI value CSIeff , and develop a refined indoor radio propagation model to represent the relationship between CSIeff and distance. Based on the CSIeff , we then design a new fingerprinting method that leverages the frequency diversity

[Improving the accuracy of ultrasound-based localisation systems]

Distance is measured using the difference in time-offlight of RF signals and ultrasound signals. The time difference for travelling a distance d between the ultrasound signal and the radio signal is t ¼ tus trf ¼ d vultrasound d vradio : For a distance d of 10 m, the radio signal needs about trf 30 ns. The ultrasound signal, however, will need about tuf 30 ms. As trf << tus, trf can safely be omitted from the above term. Unfortunately, the speed of sound is not constant. Indoors it varies mainly with temperature.

[Improving the accuracy of ultrasound-based localisation systems]

Using a sampling rate of 160 kHz, a theoretical bestcase resolution of about 2 mm could be expected. However as the signal is phase coded, the resolution cannot be less than the wavelength of the ultrasound signal, which is about 8.6 mm. To achieve this accuracy in practice, very long PN sequences are needed, which would affect memory and CPU needs as well as the position update rate. The chip rate of the signal gives an absolute worst-case resolution (upper bound) of 20 cm. Multiple measurements may be obtained from various anchors and subsequently combined in an optimal or suboptimal way to obtain an estimate of the position of the mobile device. This process of obtaining a position estimate from multiple observations is usually referred to as multilateration. Whenever the number of observations reduces to three, then the process is referred to as trilateration, or triangulation, which corresponds to classical geometric concepts.

[Indoor Localisation Using a Context-Aware Dynamic]

We presented a context-aware tracking system that tracked users in an indoor environment. The context-aware system used a wireless smart metering network that consisted of power meter nodes placed throughout a building. A user carried a mobile node that tracked their current position. A smartphone could be used to view the mobile nodes current position, via a cellular or wireless LAN connection. The context-aware tracking system localised a person’s position by combining wireless trilateration, a dynamic position tracking model, and a probability density map. The integral use of these three factors allowed the context-aware tracking system to achieve reasonable localisation accuracy with a sparsely and irregularly dispersed wireless network.

[Profiling-Based Indoor Localization Schemes]

based on a given set of RSS readings Φ, this map is explored to search for a set of Knearest neighbors (KNN) of Φ in terms of minimizing the RSS distance.

The approach proposed in [Lazik-indoorPsuedo] uses a modulation scheme similar to Chirp Spread Spectrum (CSS). A chirp is a linearly frequency modulated pulse that increases or decreases over time between two frequency ranges. Since the mobile device only knows the difference in arrival times with respect to each other and not an absolute point in time, this is called pseudoranging. A similar approach is used by GPS. This implies that the mobile devices do not need to synchronize (or explicitly communicate) with the infrastructure, which makes the approach highly scalable in the number of receivers and better for preserving privacy. Our system is also designed to work with standard speakers and ordinary mobile devices without additional hardware.

RECEIVER

[Improving the accuracy of ultrasound-based localisation systems]

We use a modified BPSK demodulator (see Fig. 5) to limit the demand for computational power. First, the received signal is transformed from a pass band signal to a base band signal by the quadrature mixer. The signal is split into an in-phase and a quadrature component. Before a data reduction stage, the signals are low-pass filtered. The resulting signals are correlated with the stored Barker code using the schema in Fig. 6. These modifications to the BPSK demodulator reduce the computational requirements to about 10 MIPS. Of course, these modifications degrade accuracy. The overall accuracy we experienced is well within our requirements (see Sect. 4.2). The resulting signal of the receiver is an envelope, showing how good the received signal matches the stored signal. The best match and thus the time of arrival of the signal can be easily determined by a search for the global maximum. . This problem shows that a search for the global maximum cannot be used in practice. We are working on a heuristic method to find the first peak in the envelope. Subsequently, sending a 13-chip Barker code and waiting several milliseconds for it to fade away yields an update rate that is comparable to the method of simultaneously sending long codes. The increased effort in decoding simultaneously sent ultrasound signals does not achieve enough improvement to justify itself.

DFT[dftandsinusoids]

SYNC

The MIT cricket [The cricket location-support system.] localization system uses the difference between RF and ultrasonic signals. The system is capable of extremely accurate range measurements, but requires line-of-sight communication, careful node positioning and high node density. It also requires tight synchronization between the infrastructure and the mobile devices. since the ultrasonic signal is a pulse, the systems are allowed to have only one active ultrasonic transmitter at a given timeslot. This principle is also known as time division multiple access (TDMA)

[Ultrasonic Time Synchronization and Ranging]

Beacon Firmware: Each Ultrasonic Beacon synchronizes with the Network Master over a single hop using its 802.15.4 radio. Once the beacon is synchronized, it plays back the ultrasonic signal stored in its flash memory at the beginning of its designated TDMA slot.

[Analysis of the Frequency Offset Effect on Zadoff-Chu Sequence Timing Performance]

Signals providing good timing estimation must possess a good autocorrelation property [1]. Wireless communication systems almost unexceptionally employ sequences that have good autocorrelation properties to fulfill such a goal. A ZC sequence is well known for its perfect autocorrelation properties. As a result, ZC sequences have found their wide applications in modern cellular systems as synchronization sequences, such as the LTE Primary Synchronization Signal (PSS) and the Random Access Channel (RACH) signal. However, the perfect time autocorrelation is in general not true in practical applications when a frequency synchronization error is present between the transmitter and the receiver. That is, the perfect autocorrelation property is lost under non-zero frequency offset, consequently degrading the timing performance of a ZC sequence. The severity of the degradation depends on both the root parameter of a ZC sequence and the time uncertainty

[Coarse Time Synchronization Utilizing Symmetric Properties of Zadoff-Chu Sequences]