Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
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Accurate Geolocation from LP-WAN / LoRa

More accurate location data for tracking IOT assets using LP-WAN LoRaWAN

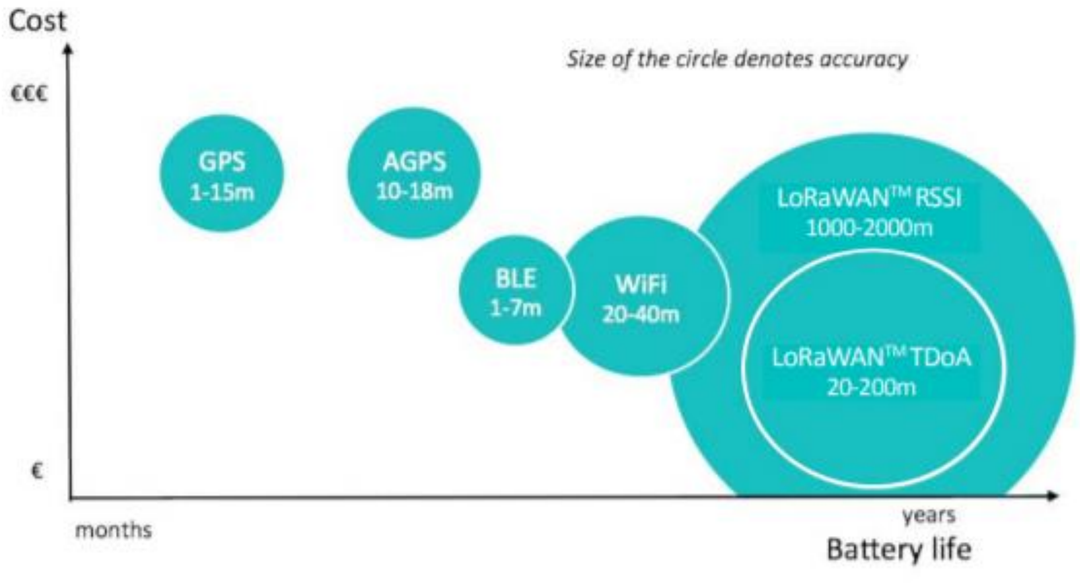
Background

A new forecast from International Data Corporation (IDC) estimates that there will be **41.6 billion** connected IoT devices, or "things," generating 79.4 zettabytes (ZB) of data in 2025. As the number of connected IoT devices grows, the amount of data generated by these devices will also grow.

LoRaWAN™ infrastructure provides a geolocation solution for low-power wide-area networks (**LPWAN**s), enabling a wide range of IOT applications requiring location determination for battery powered sensors. The geolocation functionality is supported by any existing **LoRaWAN** end-devices, eliminating additional cost and requiring no additional processing power.

The Problem With Current Geolocation Solutions

The LoRaWAN™ protocol provides two methods for geolocation determination: Received Signal Strength Indication (RSSI) based, for coarse positioning, or Time Difference Of Arrival (TDOA), for finer accuracy. Typically however TDOA can only provide accuracy of 20 to 200m at best. This solution under suitable conditions can offer close to 1m accuracy .

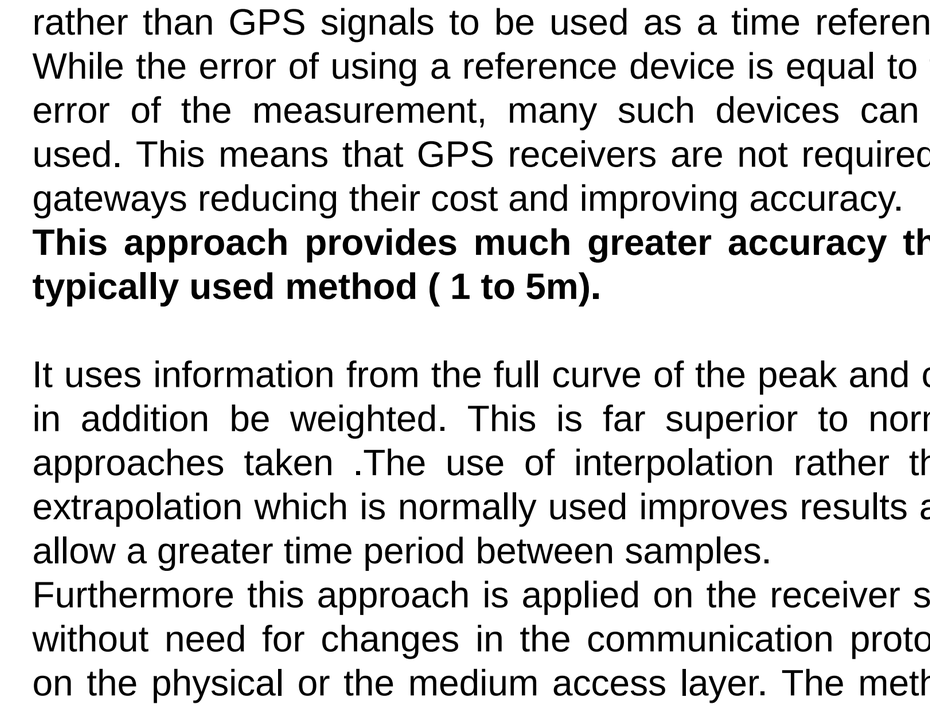


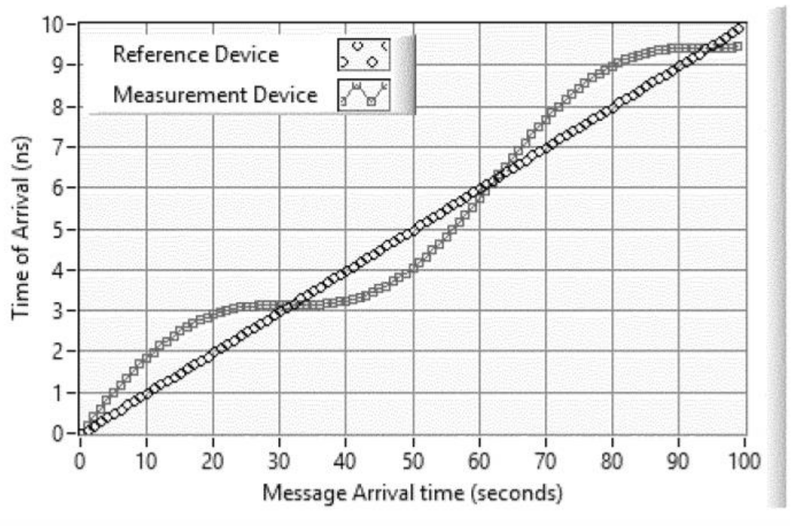
Approach and Solution to improve Accuracy

Our approach is based on a number of multi stages process each which improves the location accuracy. These are too detailed to outline here but at a fundamental level this solution allows reference devices rather than GPS signals to be used as a time reference. While the error of using a reference device is equal to the error of the measurement, many such devices can be used. This means that GPS receivers are not required at gateways reducing their cost and improving accuracy.
This approach provides much greater accuracy than typically used method (1 to 5m).

It uses information from the full curve of the peak and can in addition be weighted. This is far superior to normal approaches taken .The use of interpolation rather than extrapolation which is normally used improves results and allow a greater time period between samples.
Furthermore this approach is applied on the receiver side without need for changes in the communication protocol on the physical or the medium access layer. The method is very simple and provides significant quantifiable improvement in timing estimation. Theoretically 1m location accuracy is possible with this technique, but this is dependent on a range of parameters used in the timing determination.

Technology Status: Prototype





Benefits

A two-stage sequential search approach is deployed which has two advantages:

The received signal does not need to be oversampled. The initial low sampling rate can be maintained, since only the signal reference in the correlator is oversampled. In comparison to simple physical oversampling, the number of computations needed to determine the estimate is significantly reduced.

The commercial opportunity here simply is : **To more accurately determine the location of low cost long battery life sensors without the need for GPS in the sensor.**

When GPS is added to a sensor it adds significant cost (relative to a sensor) and battery load, increasing the cost and shortening the available life of the sensor.

Technology Sector
Telecoms, IOT, Sensors, Geolocation, LP-WAN, LES, LoRaWAN

Patent Details
"System and method to enhance ranging resolution for localization of a lora sensor or device"
WO2019068937A1
WIPO (PCT)
Priority: July 10th 2017

Opportunity
Available to License or for further collaborative work if required

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