

Precise Ultra Wideband Indoor Positioning System

Tõnis Kulm, Liisa Parv, Asfak Rahman, Alar Kuusik

Eliko
Tallinn, Estonia
tonis.kulm@eliko.ee

Kio is a precise Ultra Wideband based indoor positioning system. It is based on time-of-flight ranging and can ensure 3D positioning accuracy of 30cm using only 4 anchors. Kio is commercially available and has applications in a range of industries.

Keywords—ultra wideband; indoor positioning; time-of-flight

I. INTRODUCTION

Kio is a precise real time location system (RTLS) for positioning any object in 2D or 3D space. The RTLS is utilizing Ultra Wideband (UWB) radio communication technology and Time-of-Flight (ToF) method. UWB radio technology enables precise localization while being insensitive to interferences and disturbances. The Kio RTLS is based on Decawave DW1000 UWB transceiver.

Kio was first showcased at the Sensors Expo 2014 and the system was one of the top 10 semi-finalists of the IPSO Alliance IoT competition [1]. To date, Kio has been deployed in around ten industries, including logistics, robotics, construction and sports.

II. KIO RTLS

Kio RTLS is a cost-effective system since it is able to position in 3D with only 4 anchors and in 2D with only 3 anchors. Therefore, it is suitable for both standalone and OEM applications that require precise and real-time positioning. The main technical specifications are outlined in Table 1.

The low radio transmission level in UWB makes the technology suitable for sensitive environments. Kio operates in 3.1-4.8 GHz frequency range. The system is therefore suitable for commercial applications and is safe to use for tracking humans. The system is CE certified with the FCC certification currently pending.

The ToF ranging combined with automatic anchor management ensures that the system is straightforward to setup. Kio has a C/ C++ API for OEM applications that ensures easy software integration with existing systems.

TABLE I. KIO SPECIFICATIONS

Kio Specifications	
Operational distance	40m line-of-sight
Communication standard	IEEE802.15.4-2011-UWB
Positioning accuracy	30cm
Ranging rate	5 Hz for USB powered device 1 Hz for battery powered device

III. DEPLOYMENT CONDITIONS

The 3D positioning requires 4 anchors to be positioned in a diagonal manner so that the first two anchors are close to the floor and the second two anchors are close to the ceiling. The distance between the anchors should be less than 40 metres in line-of-sight. However, for real world applications with no line of site the recommended distance should not be more than 25 metres.

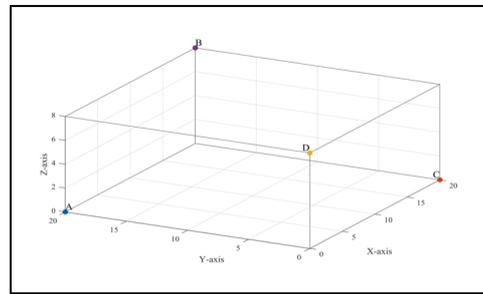


Fig. 1. Recommended anchor position for 3D

Compared to other systems, Kio is easily scalable. To add another room, site or area, it is only necessary to add a new set of anchors and collect the data from there. The system can support the tracking of countless objects. In case of tracking more than one tag or object, one needs to turn the additional tag on, and it is immediately visible in the anchor area. There are no additional hardware configurations or software adjustments needed.

The precise position of the anchors, i.e. the XYZ coordinates, needs to be carefully measured. This data is used as input information in the Kio API software. No additional calibration is required for setting up the system.

The data can be collected from both the anchors and the tags via a USB interface. The tags can be either battery-powered or use standard power supply. However, the anchors require power supply (via μ USB).

IV. CONCLUSION

Kio is well suited for locating moving objects that need continuous, real time positioning. With a positioning error level below 30cm, the UWB-based RTLS is at least 10 times more accurate compared to Wi-Fi or Bluetooth Smart beacons.

- [1] IPv6 Enabled Indoor Positioning System. IPSO Alliance Webpage <http://challenge.ipso-alliance.org/ipso-challenge-2014/ipv6-enabled-indoor-positioning-system>