The Optimized Detection Range of RFID-based Positioning System using *k*-Nearest Neighbor Algorithm

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Abstract

The positioning technology for a moving object is an important and essential component of ubiquitous communication computing environment and applications, for which Radio Frequency IDentification Identification (RFID) is has been considered as also a core technology for ubiquitous wireless communication. RFID-based positioning system calculates the position of moving object based on k-nearest neighbor (k-nn) algorithm using detected k-tags which have known coordinates and k can be determined according to the detection range of RFID system. In this paper, RFID-based positioning system determines the position of moving object not using weight factor which depends on received signal strength but assuming that tags within the detection range always operate and have same weight value. Because the latter system is much more economical than the former one. The geometries of tags were determined with considerations in huge buildings like office buildings, shopping malls and warehouses, so they were determined as the line in 1-Dimensional space, the square in 2-Dimensional space and the cubic in 3-Dimensional space. In 1-Dimensional space, the optimal detection range is determined as 125% of the tag spacing distance through the analytical and numerical approach. Here, the analytical approach means a mathematical proof and the numerical approach means a simulation using matlab. But the analytical approach is very difficult in 2- and 3-Dimensional space, so through the numerical approach, the optimal detection range is determined as 134% of the tag spacing distance in 2-Dimensional space and 143% of the tag spacing distance in 3-Dimensional space.This result can be used as a fundamental study for designing RFID-based positioning system.

1. Conclusion

In the advent of ubiquitous communication computing environment, the positioning technology becomes more and more important and essential and RFID-based positioning system using k-nn algorithm can be a core technology. In the economical aspect, the system was suggested without weight factor and the optimal detection range should be determined in 1-, 2- and 3-Dimensional space. From the simulation results, the optimal detection range is 125% of tag spacing distance in 1-Dimensional space, 134% of tag spacing distance in 2-Dimensional space and 143% of tag spacing distance in 3-Dimensional space. It can be used as the premise theory for the design guideline for RFID-based positioning system

and other applications using k-nn algorithm.

In this paper, simulations were conducted to determine the optimal detection range of RFID-based positioning system but there are many design factors such as detection rate of tags, standard deviation of detection range of RFID reader and multi-level range which gives weight factor to each tags' coordinates according to received signal strength. In order to know how each design factor have afftectsan effecton the positioning accuracy, the optimal detection range should be adjusted. So study about guidelines for these design factors of RFID-based positioning system will be conducted based on this optimal detection range.

2. References

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