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Activity Recognition in Future Library based on RFID

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1. Motivation

Who

Where

What

- The core part of Internet of Things(IoT) is perception, which can provide upper application and service abundant knowledge.
- E.g., personalized recommendation, reading behavior analysis, book management, misplace detection, etc.
- RFID is already widely used in Library.

2. RFID phase

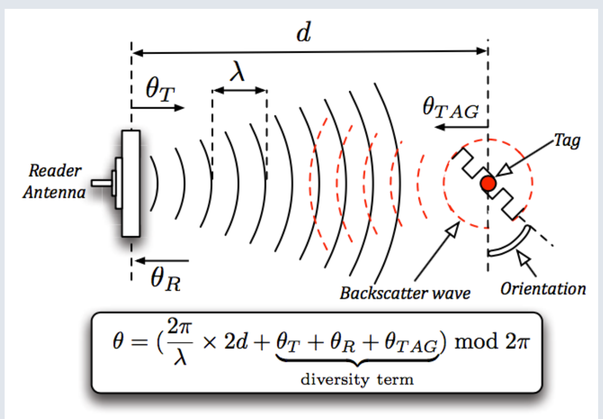

Figure 1

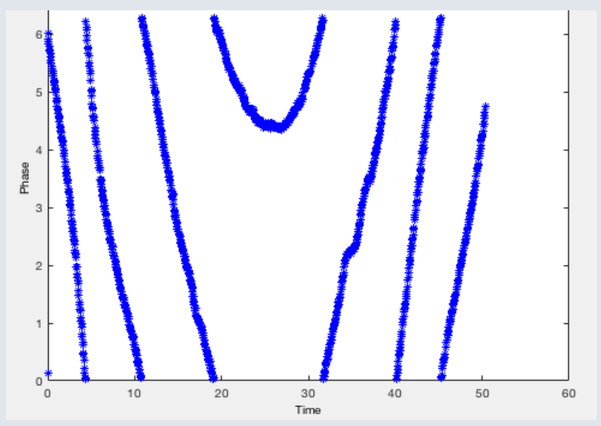

Figure 2

- According to Fig.1, phase is determined by several parameters. However, for the static tag, phase is mainly affected by distance. Fig.2 shows the relation between phase and distance.
- As the same with other wireless signals, RFID is also inevitably affected by multi-path.

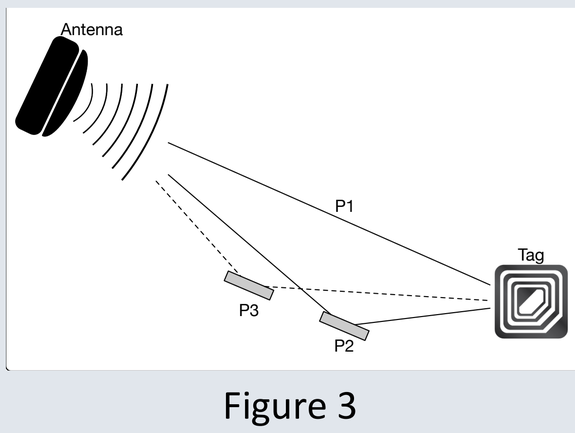

Figure 3

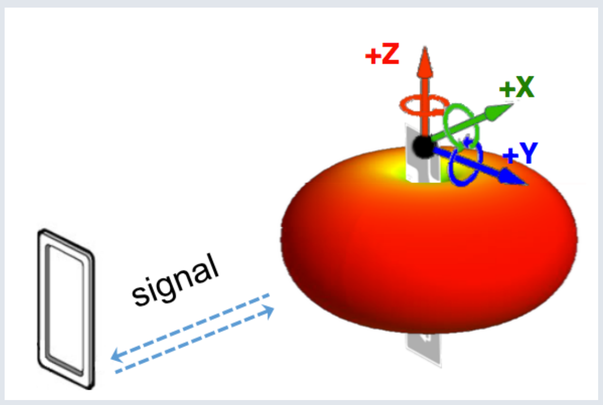

Figure 4

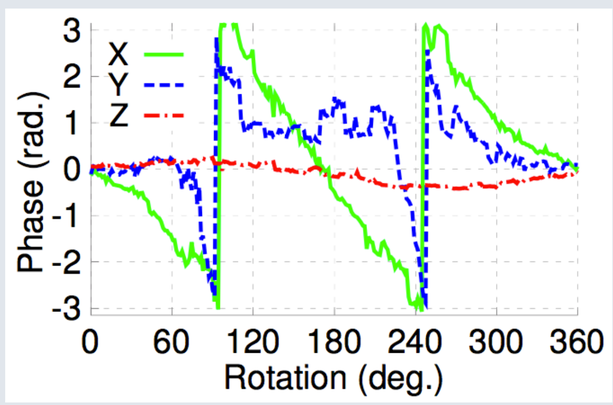

Figure 5

- The rotation of tag will change ϑt, thus change the phase. Fig.5 shows shows the detail relation.

3. Method

- Knowing the characteristic of RFID phase, we find that different activities will influence the phase differently.

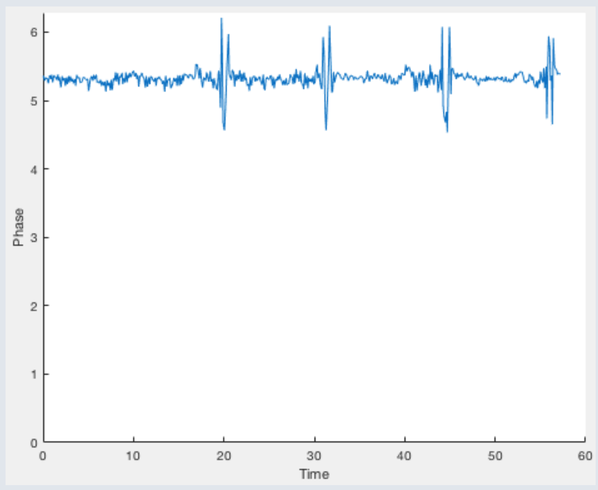

Figure 6

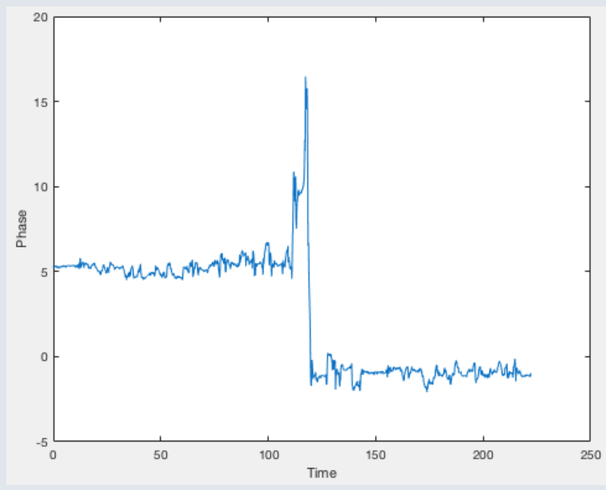

Figure 7

- Fig.6 shows that when someone passes before a book, the phase will fluctuate. Fig.7 shows that when a book is picked up, the phase will fluctuate wildly. Because the former only causes multi-path, while the latter both changes the distance and angle.
- Therefore, we use standard deviation to describe the phase value distribution in a sliding window. In this way, we can easily distinguish two activities: walking before a book and picking up a book.

4. Experiment

- As is shown in Fig.8, the experiment is carried out in real scenario. The average error rate is lower than 7%

5. Future Work

- The order of books is known by the system. Then we can track the reader by analyzing the all the books on the bookshelf rather than respectively. Combining with Wi-Fi localization, we can achieve the goal of detecting: Who is reading What at Where.

References

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