WiFi-Based Indoor Positioning System

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CONTENTS

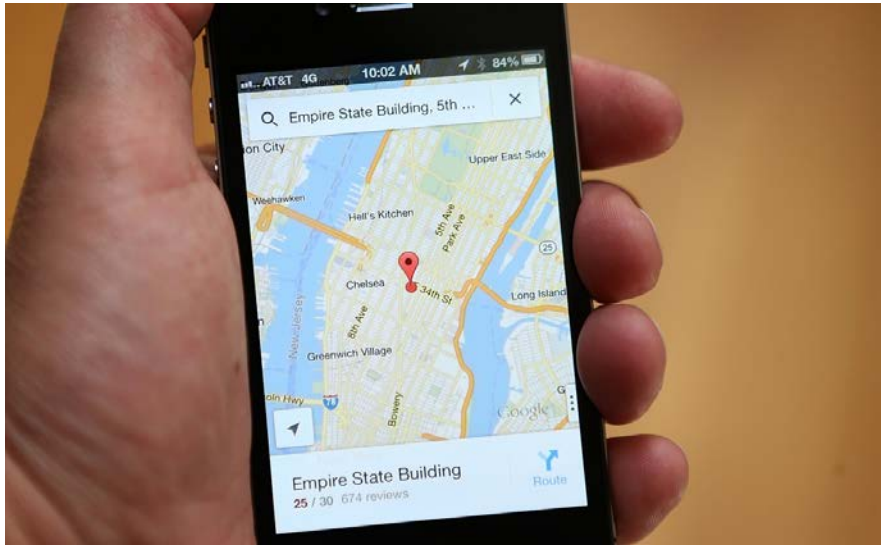
1

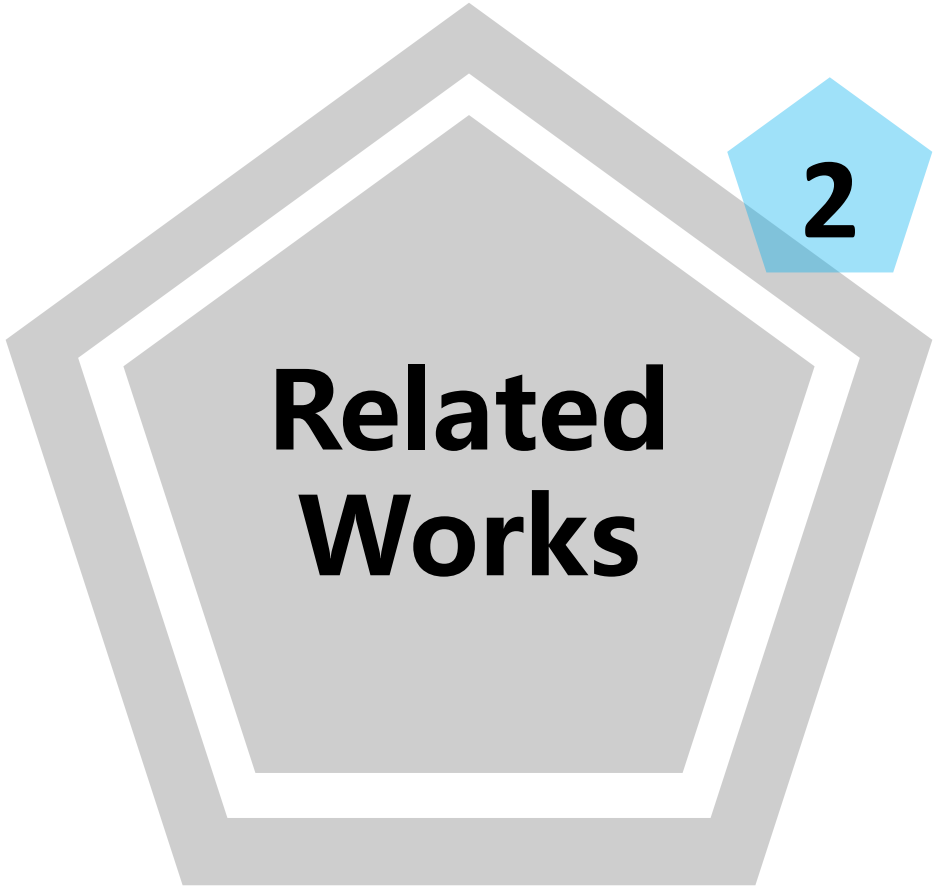
Research Background

Reserch Backgrounnd

What is Indoor Localization?

Why we need it?




2
Related
Works

Related Works -- A Widely Used Method

Received Signal Strength (RSS) Value & Log Distance Path Loss (LDPL) Model

$$PL = P_{Tx_{dBm}} - P_{Rx_{dBm}} = PL_0 + 10\gamma \log_{10} \frac{d}{d_0} + X_g$$

- Given **PL0**, **d0** and **γ**, the RSS measurement **PL** can be converted into the distance **d** using the **LDPL** model.

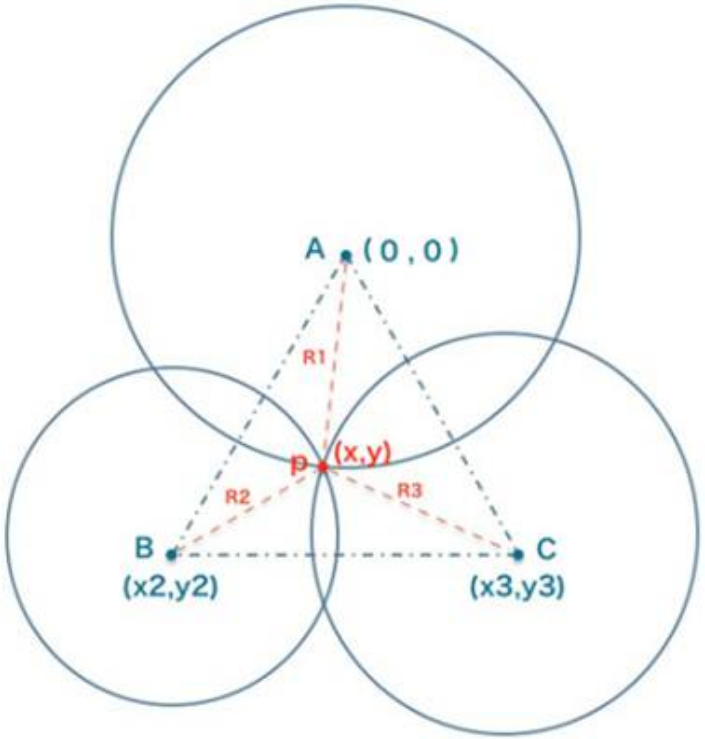
- **PL0** is the path loss at the reference distance **d0**.
- **Xg** is a Gaussain random variable with zero mean.

Related Works -- A Widely Used Method

Triangular Positioning

- By LDPL model, if we recive at least three RSSIs, we can calculate the user's location.

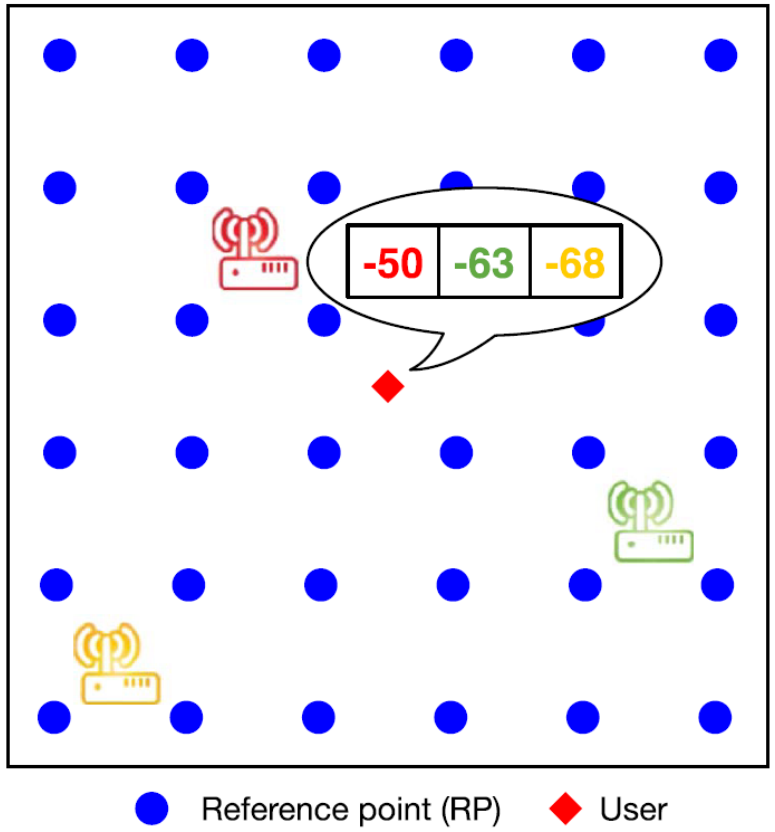
- Because of the Gaussian noise, we cannot always find the user's location accuratly.



Related Works -- Some Other Methods

Fingerprinting-based Location Method

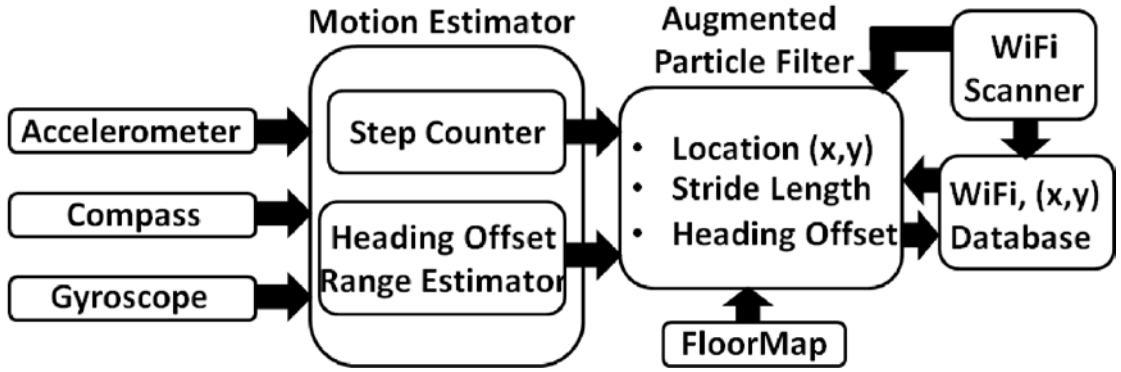
- **Offline phase:** Many site surveys are conducted to build an RSSI database.
- **Online phase:** User samples an RSSI vector at it's position and send it to the server, sever returns the location to the user.



Related Works -- Some Other Methods

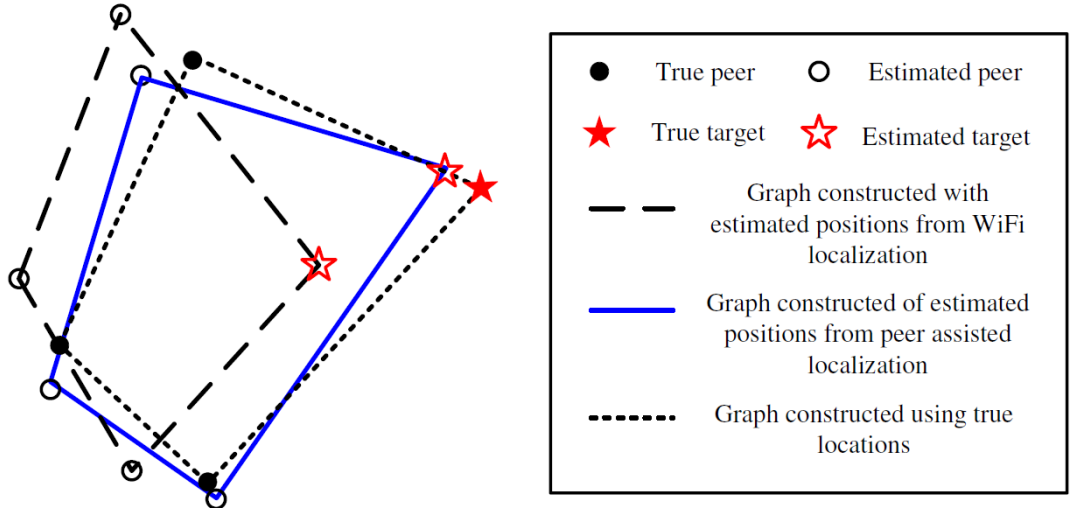
Zee System

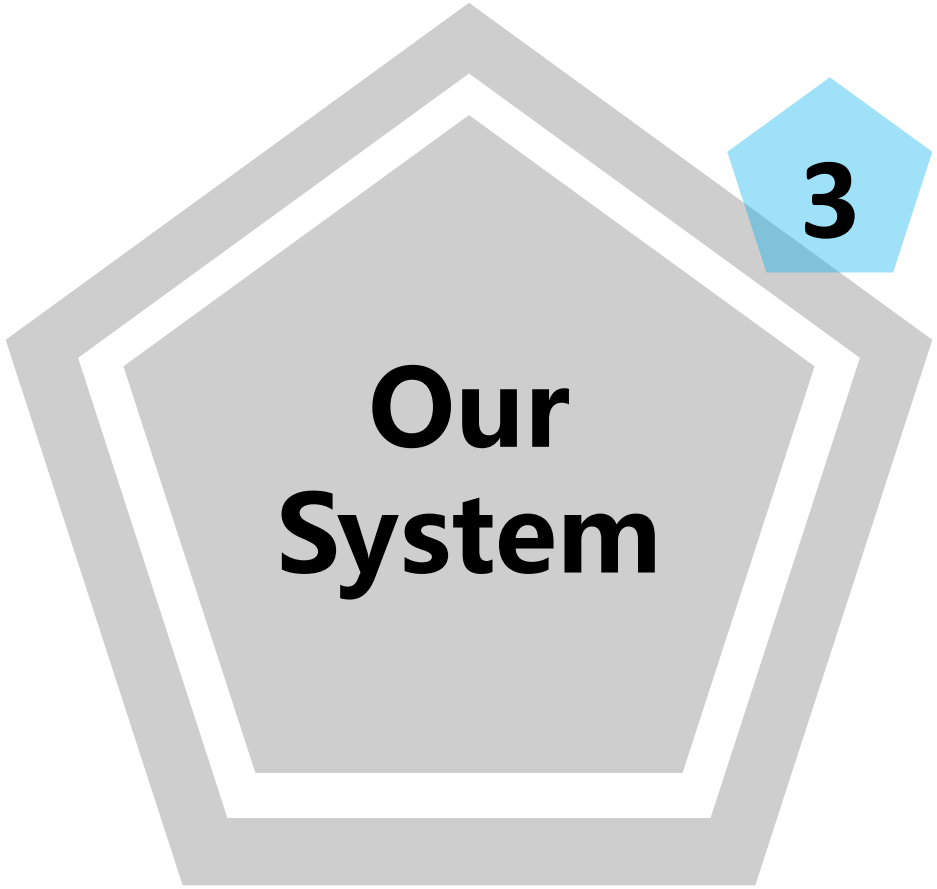
- Ease the offline phase by make every user an RSSI data collector
- Use Augmented Particle Filter to estimate the trajectory with high accuracy



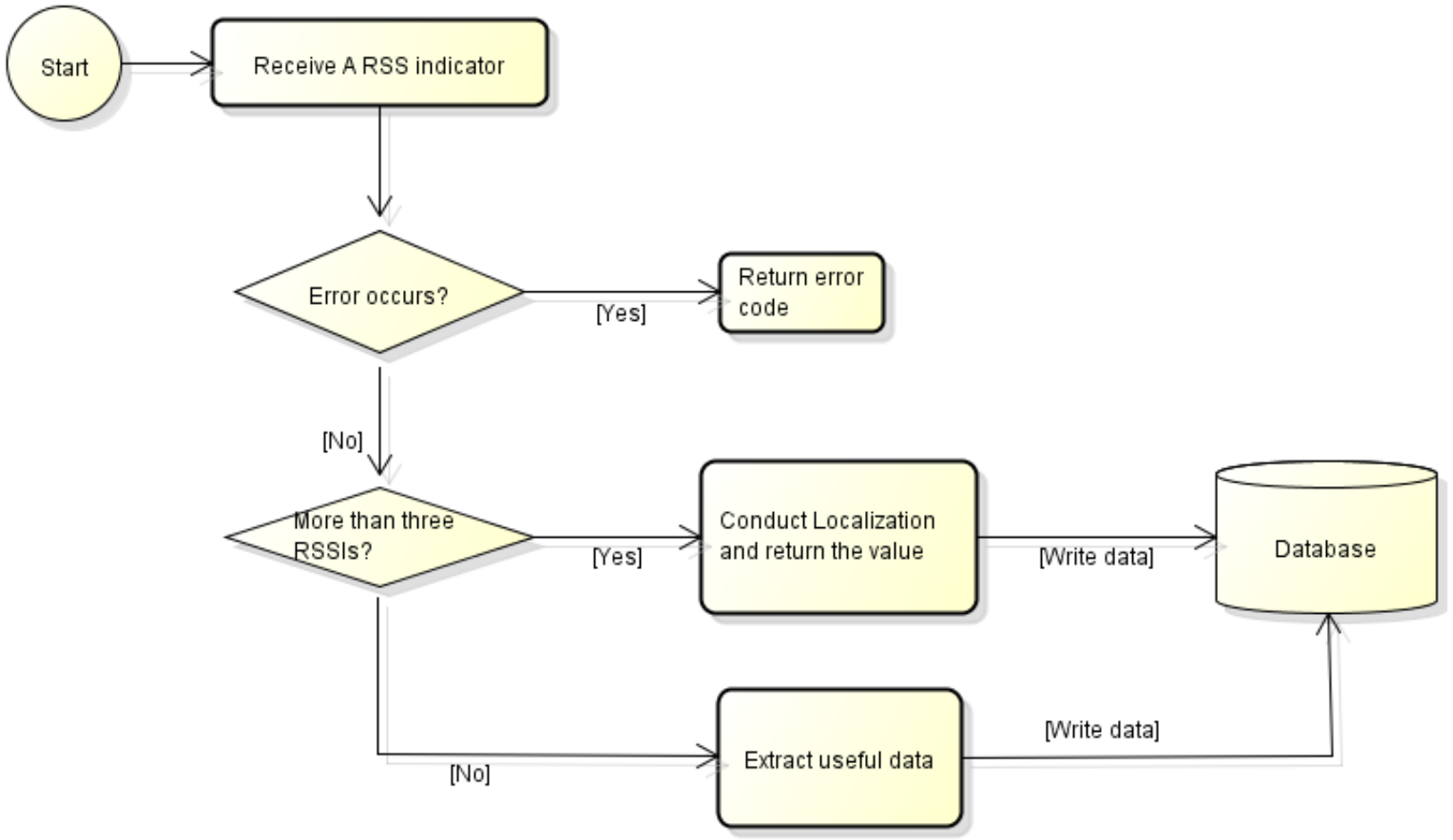
Peer Assisted Location

- Users' devices broadcast special audio signals, thus we can calculate the distance between the users by TOA.
- Location accuracy is improved by additonal distance infomation.




3
Our
System

Our System -- The Architecture




```
| Tables_in_foxconn |
|-------------------|
| BLE               |
| Lyy               |
| account           |
| anchor            |
| books             |
| invitation_code   |
| locrecord         |
| mapdb             |
| position_history  |
| rho_pos           |
| rss_pos           |
| rssi              |
| rssihis           |
| rssitable         |
| tempo             |
| users             |
| wifi_name         |
```

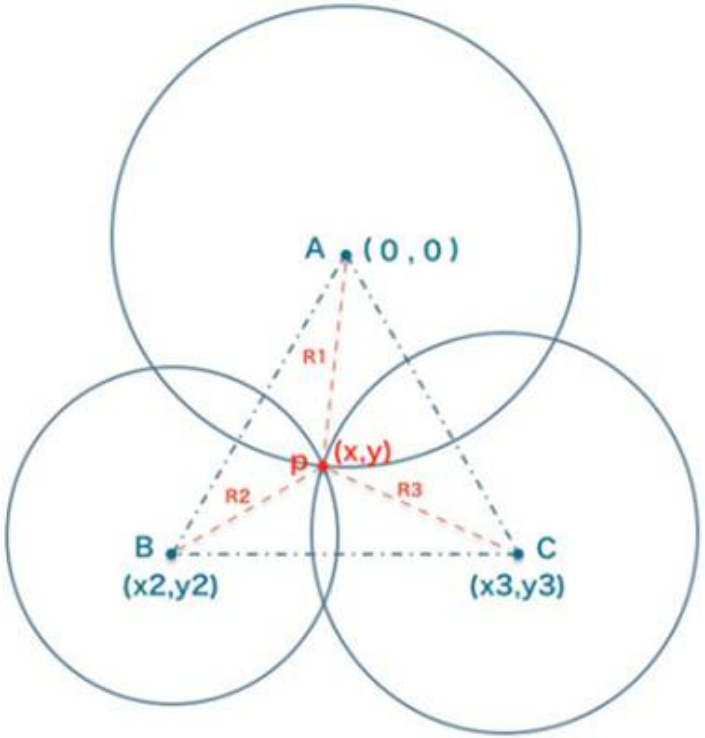
Our System-- Algorithm

LDPL model with triangular positioning method

$$PL = P_{Tx_{dBm}} - P_{Rx_{dBm}} = PL_0 + 10\gamma \log_{10} \frac{d}{d_0} + X_g$$

1. RSS threshold for localization

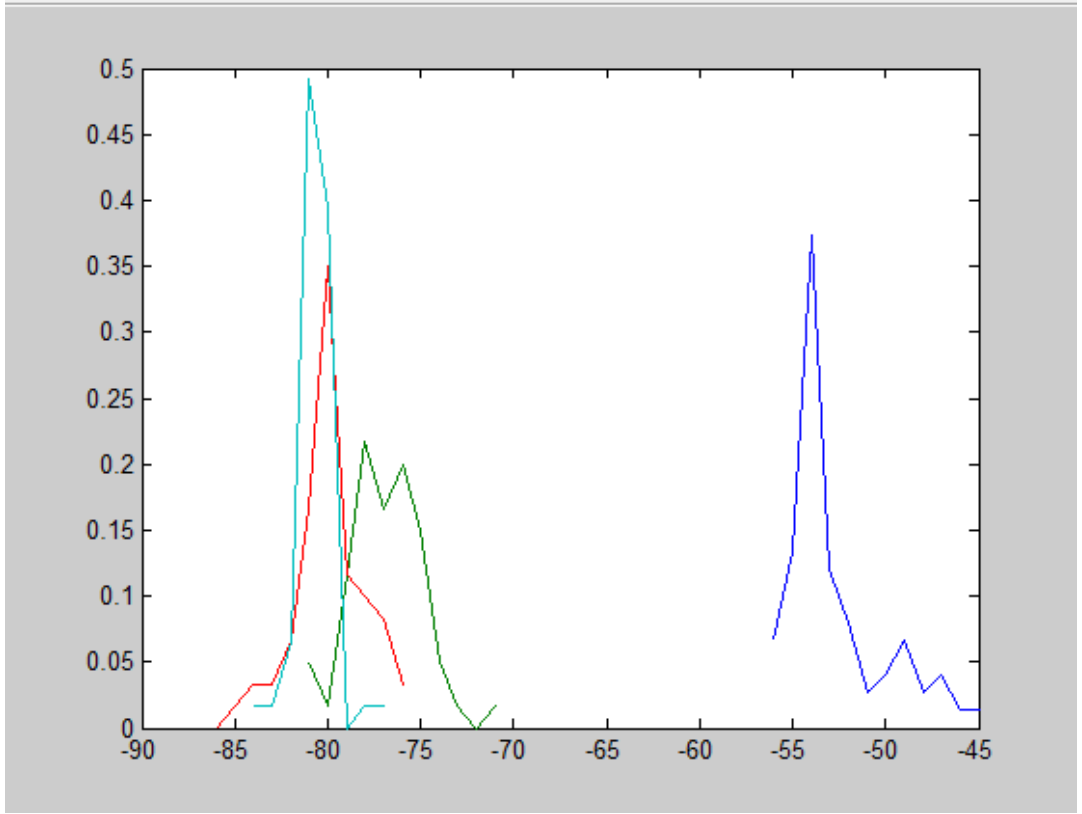
2. Kalman filter

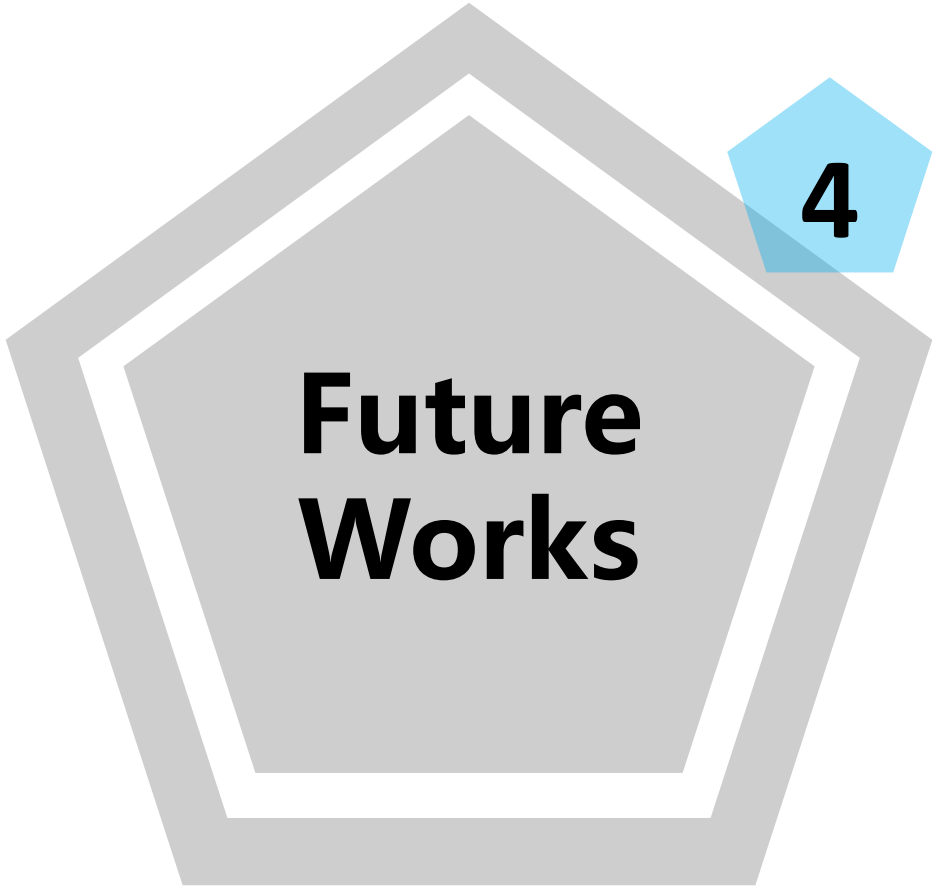


Our System

Use Kalman Filter to modify the RSS value to improve the accuracy.

Predicte_rssi = last_est + kg*(rssi-last_est)



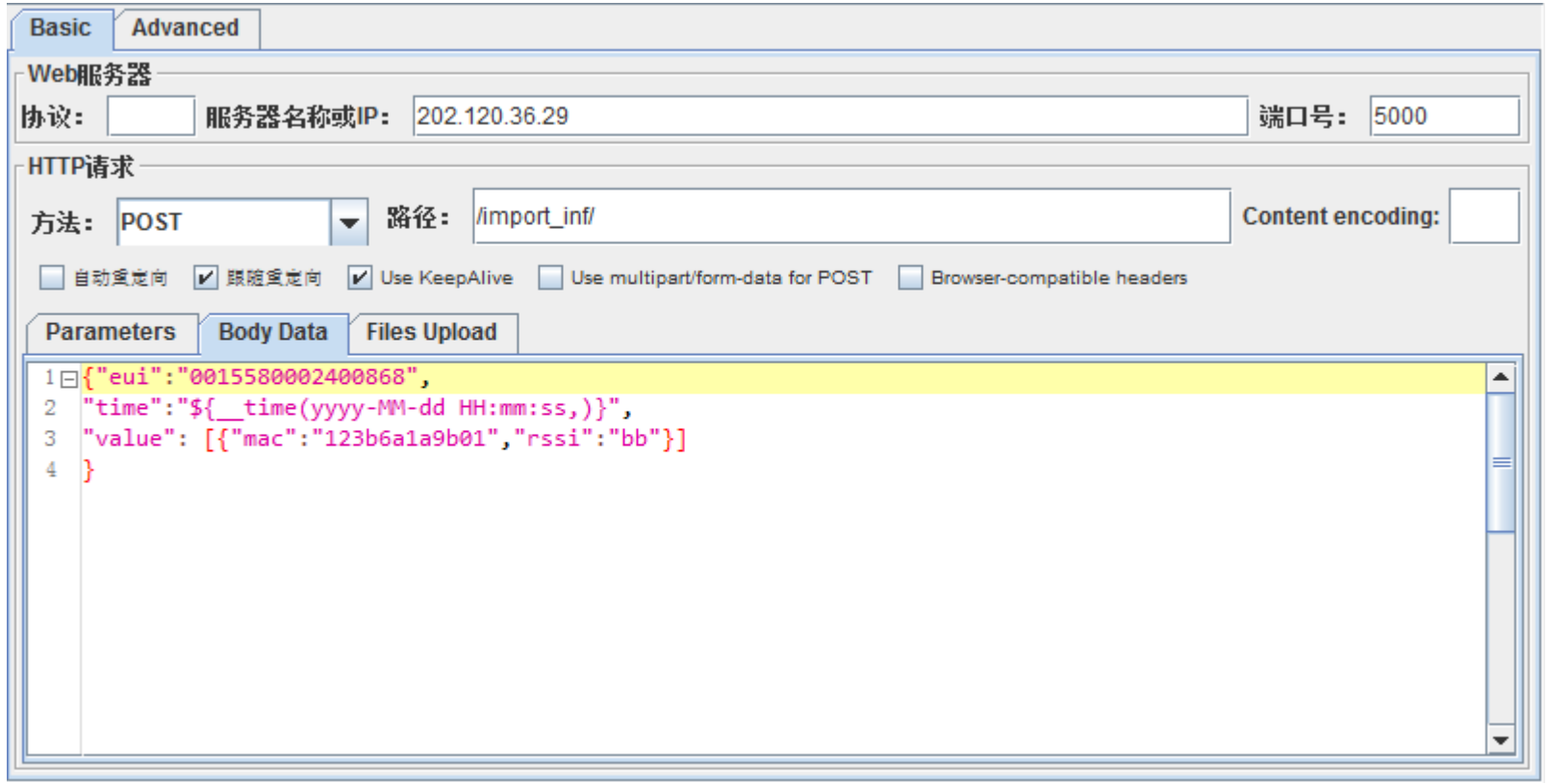

4
Future
Works

Future Works

- Pressure Test
- Code refactoring, rearrangement of database

Future Works

Pressure Test



Future Works

Pressure Test

200	22:06:44.935	线程组 3-235	HTTP请求	3204		2760	0	0	0
201	22:06:44.943	线程组 3-355	HTTP请求	3196		2760	0	0	0
202	22:06:44.933	线程组 3-465	HTTP请求	3208		2760	0	0	0
203	22:06:44.955	线程组 3-396	HTTP请求	3186		2760	0	0	0
204	22:06:44.929	线程组 3-405	HTTP请求	3212		2760	0	0	0
205	22:06:44.932	线程组 3-453	HTTP请求	3210		2760	0	0	0
206	22:06:44.951	线程组 3-360	HTTP请求	3191		2760	0	0	0
207	22:06:44.451	线程组 3-115	HTTP请求	3692		285	0	3692	0
208	22:06:44.435	线程组 3-174	HTTP请求	3709		285	0	3709	0
209	22:06:44.435	线程组 3-166	HTTP请求	3724		285	0	3724	0
210	22:06:44.440	线程组 3-201	HTTP请求	3752		285	0	3752	0
211	22:06:44.456	线程组 3-111	HTTP请求	3753		285	0	3753	0
212	22:06:44.445	线程组 3-192	HTTP请求	3787		285	0	3787	0
213	22:06:44.438	线程组 3-186	HTTP请求	3802		285	0	3802	0
214	22:06:44.428	线程组 3-175	HTTP请求	3826		285	0	3826	0
215	22:06:44.457	线程组 3-150	HTTP请求	3803		285	0	3803	0
216	22:06:44.450	线程组 3-103	HTTP请求	3815		285	0	3815	0
217	22:06:44.414	线程组 3-199	HTTP请求	3857		285	0	3857	0
218	22:06:44.465	线程组 3-159	HTTP请求	3809		285	0	3809	0
219	22:06:44.439	线程组 3-155	HTTP请求	3850		285	0	3850	0
220	22:06:44.499	线程组 3-250	HTTP请求	3796		285	0	3796	0

The Bottlenecks:

1. **Connections to DB**
2. **Disk read/write**
3. **CPU**

Reference

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- S. He and S.-H. G. Chan. Wi-fi fingerprint-based indoor positioning: Recent advances and comparisons. *IEEE Communications Surveys & Tutorials*, 18(1):466–490, 2016.

- K. Chintalapudi, A. Padmanabha Iyer, and V. N. Padmanabhan. Indoor localization without the pain. In *Proceedings of the sixteenth annual international conference on Mobile computing and networking*, pages 173–184. ACM, 2010.

THANK YOU