Critique 3 | Week 3 | Disha Singh

The two papers given are published 12 years apart and try to solve the problem of Indoor Localization by using two very different techniques. Finding and tracking a user can be beneficial for location aware services and hence this is pursued in the *RF based User Location paper* (2000) using the RADAR technology, whereas the other paper *Unsupervised Indoor Localization* (2012) uses the sensors and tools in mobile devices (accelerometer, magnetometer, gyroscope, WiFi, compass) to find user location based on location of Landmarks whether Organic (temporary) or Seed (foundational/fixed).

Back in 2000, the research done by Microsoft seems to be thorough, except the fact that it is a small scale research with only 3 Base Stations. Every pitfall has been taken care of, like they clearly say that they were able to use the simple linear time search algorithm only because their dataset is small (70 locations * 4 orientations=280). They also mention that in real-world/production, packets (beacons) should be sent from base stations(few) to hosts(many) instead of host to base station as in case of their research due to presence of only a single host. This however does not impact the research's results, they say.

This paper has solved the previous problem with IR which does not give ubiquitous coverage. Here the 3 base stations always overlap a user's location on the floor and hence always under good coverage. I only felt that we do not know via this paper how this would behave if the user went to another floor and the host and base station were not on the same floor. A question I would like to ask in class is what was the need to process data and collect it as median, mean, why can't we use it as such?

The 2012 paper shows how the problems can be solved on a bigger scale, and how much more data can be collected using the sensors of the mobile phone. For example, gravity information from elevators, metal detection using magnetometers for landmark identification is extremely valuable which couldn't have been possible with RADAR technology, where even to detect walls in the room, the floor plan was required along with a line clipping algorithm. Given these sensors, all that is required is the ground truth location of just one landmark of the building, that too *if possible.* Post that, user location is identified based on the dead reckoned data (from accelerometer tracking and movement) and the error in location is corrected recursively by identifying landmarks, thus increasing accuracy. This unique application of Unsupervised Learning on all sensor data to identify seed or organic landmarks amuses me. I found the WiFi partitioning theory interesting and how it enables to break ties on similar landmarks like doors, as each door has its own WiFi subspace.

In the last critique discussion, we saw how the sensor data varies based on the orientation of the phone and it's location on the body. In the 2012 *UnLoc* research however, the phone is kept in 2 locations – one hand, one pocket, with screen facing up and that's it. That reduces the real world reliability of the results. Additionally, the 3 buildings - the computer science, engineering and north gate mall could be similar in terms of architecture which could have resulted in a good landmark detection, which would not be the case in real world filled with very diverse furniture, makeup and materials. Regardless, many limitations have been cited as future work in the paper already and more work is expected after this introductory research.