Suhas Bettapalli Nagaraj

EE 597 IoT Review 5

21 September 2020

No Need to War-Drive: Unsupervised Indoor Localization

The main motivation that is behind this paper is the fact that there needs to be a higher accuracy for indoor localization. The authors provide a new idea of combining three points - namely, dead reckoning, urban activity sensing, and WiFi based partitioning.

The authors propose using the sensor fusion of accelerometer, magnetometer, compass, gyroscope, and WiFi access points. In this paper, the authors propose that each part of a building would have its own distinct features which can then be exploited for improving indoor localization.

Along with this, it is seen that each part of a building might force a user to perform a "certain" type of behavior while interacting with that part of the building. The authors in the paper identify this distinct pattern as landmarks, as long as the pattern happens in a small area (the paper uses 4 m^2) which is inferred from WiFi localization. From here, the paper offers a framework to learn this pattern recursively over time.

In addition to the above, as mentioned earlier, the authors propose using GPS signals to mark an entrance to a building to make sure the accuracy of starting learning point. The experiment was performed in three different buildings on top of an Android smartphone.

This paper offers a new method to achieve 1.69 m (169 cm) accuracy with zero calibration, thus as the title says, there is no need for war-drive. This method is better when compared to several existing methods since it does not need additional equipment to perform localization.

Previous indoor localization works such as Horus, perform much better with an accuracy of ~1 m. However, Horus has the requirement for war-driving as a trade-off. There exists other non-war-driving approaches such as **EZ** (2-7m) and **SLAM** (~5m) which perform with a lower accuracy.

As mentioned earlier, the UnLoc methodology achieves a relatively higher localization accuracy than other comparable techniques. As seen in other cases, the method does perform better with more data. However, early users will experience less accurate localization results due to lesser data.

However, there were a few points that needed more clarity :

Questions :

1. The authors prefer to not use sensors such as light or sound since they need higher energy when compared to accelerometer/gyroscope. However, light or sound could offer higher localization accuracy - which is the main aim of the paper. Is there a way these sensors can be made use of?
2. Results may vary between different smartphone hardware and operating systems, but the paper has not tested this plausible real-life implementation. This is important to test the real world scenarios in more detail.
3. The experiment asks the users to do a certain orientation - the question arises that will it still be robust when users face another direction in real practice?
4. There needs to be some mention regarding the wait time in order to get the localization result - which is critical in a real time localization system.

More details about the paper

Wang, H., Sen, S., Elgohary, A., Farid, M., Youssef, M., & Choudhury, R. R. (2012, June). No need to war-drive: Unsupervised indoor localization. In Proceedings of the 10th international conference on Mobile systems, applications, and services (pp. 197-210).