Where Has All The Smartphone Sensing Gone?

VELJKO PEJOVIĆ, Faculty of Computer and Information Science, University of Ljubljana, Slovenia

Like no other device, the smartphone has profoundly influenced mobile sensing research. From pioneering studies of human socialisation, over the first wave of behavioural change intervention apps, to fine-grained and large-scale monitoring of student life, the smartphone has served as a tool for collecting highly personal data, delivering tailored information, and running sophisticated machine learning models.

In the last decade or so, however, the popularity of the smartphone as a research tool has declined. I examined publication trends from two major conferences dedicated to mobile sensing – ACM MobiSys and ACM SenSys – which reveal that over time researchers increasingly abandoned the smartphone as the platform of choice. Specifically, I examined 376 full-length research papers published in MobiSys and 321 such papers published in the SenSys proceedings from 2013 to 2023, and for each year, I counted the publications that focused on experiments using Android phones[1]. The results of the analysis, depicted in Figure X, demonstrate that once massively dominant within the research community, Android has dramatically lost popularity. By 2023 Android was the tool of choice in only 24% of the papers published at MobiSys, a drop of two-thirds from its peak in 2015, when Android was used by 72% of MobiSys papers.

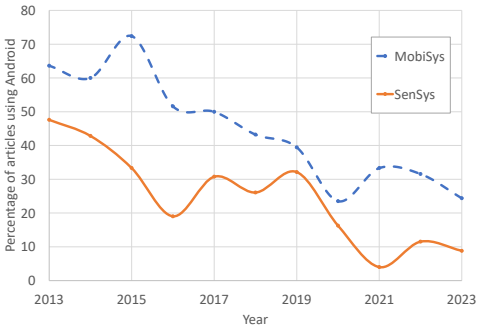

Fig. 1. Android used to figure in almost three quarters of the MobiSys and almost a half of SenSys research papers. A decade later, this has changed to less than a quarter and less than a tenth of papers, respectively.

A further analysis of the conference papers reveals that the decline of smartphone sensing did not happen because another platform, e.g. wearables or earables, has gained in importance. Rather, I postulate that the real reason mobile sensing researchers are turning away from the smartphone is due to manufacturers' efforts to make the smartphone more appealing to the average consumer.

The ability to capture a user's context, often longitudinally and often without their awareness, is what made the smartphone so enticing to early mobile sensing researchers. Yet, such operation raises significant issues. First, frequent processing and sensing, even if lightweight, prevent the device from going to a low-power mode, which in turn can drastically shorten a mobile phone's battery life. Second, the modalities collected through mobile sensing studies are often rather sensitive. Today, it is generally accepted that a user's location, voice, photos and videos should only be accessed with a user's full awareness and consent. Over the years, Android has evolved to limit unrestricted background sensing. Thus, the *Doze* mode was introduced in 2015. In this mode, if not actively used, the device spends most of its time in a power-saving mode in which background processing is not permitted. Apps that require background processing can still run, but only during *maintenance periods*. To strengthen data protection, Android has also introduced new permissions, for instance those related to human activity sensing, and further restricted location sensing. Consequently, location sensing in the background is pretty much out of reach for most mobile apps.

The smartphone continues to be the most ubiquitous highly personal computing device in the world, and it's fair to ask: Is there anything we can do to revive smartphone sensing? In my talk, I will present some ideas on how to restore the smartphone to its original research glory.

[1]Additional results can be found in my IEEE Pervasive Computing article https://ieeexplore.ieee.org/document/10963688