Poster: Understanding Mobile User Interactions with the IoT

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The increasing reach of the Internet of Things (IoT) is leading to a world rich in sensors [3] that can be used to support *physical analytics* – analogous to web analytics but targeted at user interactions with physical devices in the real-world (e.g. [2]). In contrast to web analytics, physical analytics systems typically only provide data relating to sensors and objects without consideration of individual users. This is mainly a consequence of an inability to track individual mobile user interactions across multiple physical objects (or across sessions of interaction with a single object) using, for example, an analogue of a web cookie. Indeed, such a "physical analytics cookie" could raise significant privacy concerns.

However, in many cases a more "human-centric" approach to analytics would enable us to provide new and interesting insights into interactions between mobile users and the physical world [1]. In our work we endeavour to leverage synthetic user traces of human mobility, and data from real IoT systems, to provide such insights.

To illustrate this concept, we have combined simulations of human mobility with energy data coming from a university-wide IoT energy hub. Simple mobility models represent students and staff and their different behaviour patterns on campus. The energy hub provides half-hourly electricity meter readings for each campus building. When combined, our analytics approach allows us to produce entirely new insights about the energy impact of individuals rather than buildings – demonstrating the potential of human-centric analytics.

An example of the new types of report that can be produced is presented in Figure 1 which shows the resulting energy distributions in kilowatt hours for three different simulated mobility models (2,000 synthetic people per model each for two simulated weeks on campus). As individuals follow different mobility paths, and spend differing times in buildings with higher or lower energy intensities (due to more or less energy-intensive equipment, infrastructures and activities), they accrue a different portion of the energy spend apportioned per head. Such reports allow a fundamentally different understanding of how energy is "spent" to support different activities and student cohorts, rather than in terms of specific buildings or energy meters. While Figure 1 illustrates the concept, we recognise that our mobility models can be strengthened e.g. by using real mobility traces from WiFi fingerprinting, to improve the accuracy of the energy estimates.

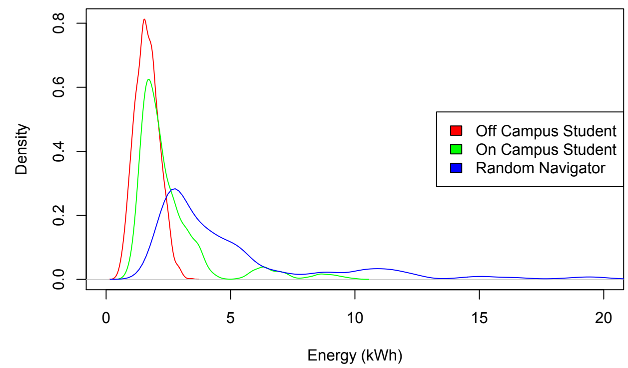

Figure 1: Energy use (kWh) per mobility model for 14 days. Building baseline energy use is apportioned equally.

We believe that the proposed approach will help researchers move towards a human-centric view on analytics data without violating privacy requirements of individuals. Through the combination of detailed synthetic mobility traces with historical datasets we are able to produce novel insights into the mobility and interaction patterns of users across a range of devices and pervasive computing systems.

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References

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