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Setting up the infrastructure to support a smart city can be affordable

THE announcement on plans for 100 Smart Cities across India has generated significant excitement. However, deploying completely new infrastructure and the associated connectivity backbone may prove to be prohibitively expensive in existing, crowded, organically-evolved cities such as Varanasi and Coimbatore.

In such environments, two ICT technologies – (a) mobile and wearable sensing and analytics and (b) crowd-sensing – are likely to play a vital role.

The rapidly-expanding base of citizens' smartphones and wearable devices will usher in an "urban sensing" revolution (similar to the connectivity revolution unleashed previously by mobile telephony).

Mobile/wearable sensing and analytics: Smartphones and "wearables" (such as smart watches) have evolved well beyond simple communication or multimedia consumption devices. Modern smartphones contain more than 10 embedded sensors, which can help capture and infer a variety of everyday human activities. For example, signals from mobile-embedded sensors such as the accelerometer, gyroscope, compass, GPS and microphone can indicate a person's locomotive state (whether she is walking, standing or climbing stairs) or the mode of transportation taken (pedestrian, in a bus or train).

Similar sensors on smart watches can capture eating habits (when, how many mouthfuls and whether one used hands, chopsticks or forks) or identify everyday gestures (such as jostling in crowded buses).

In ongoing research at SMU, my colleagues and I are working to demonstrate such capabilities in public urban spaces. Using mobile and wearable data captured from explicitly opted-in student participants, we have deployed a large-scale indoor location system on the SMU campus (that tracks the movement of anonymised individuals using a smartphone's Wi-Fi signals), developed a group analytics platform that identifies group interaction based on such location data (and exploits group behaviour to identify unusual events on campus), and a queueing analytics platform that uses a smartphone's accelerometer and compass to detect a person's queueing episodes (and thus estimate waiting times) at foodcourts. Besides being voluntary participants, our students also benefit from exclusive student-centric services and apps that leverage on these insights.

Crowd-sensing: To enable real-time information gathering about urban resources, I expect the gradual adoption of crowd-sensing, where the smartphones of citizens (embedded with the mobile analytics capabilities described previously) form a distributed, city-wide sensing substrate.

As a simple example, researchers at IIT Bombay are exploring the use of smartphone sensors (GPS and accelerometer) carried by commuters to obtain continual updates of bus movement speeds and road conditions (e.g. untended potholes). More importantly, innovation opportunities abound for tailoring technologies to address novel challenges in Indian markets.

For example, researchers in Sweden have utilised user-carried smartphones to capture a driver's driving habits, such as abrupt braking or sharp turns, for use in customised auto insurance policies. How about adapting such techniques to public buses in India, where commuting smartphones provide similar data to both identify reckless drivers and, more creatively, identify maintenance issues with the buses themselves (e.g. uneven braking at stops or over-dampened suspensions)? No one will then underestimate the watchdog potential of the "aam admi (common man)"!

In a similar vein, we're exploring at SMU the use of crowd-sourced smartphones to provide opportunistic connectivity between low-cost sensors attached to everyday objects (such as trash cans) and cloud-based real-time campus monitoring applications. These approaches may then be adopted citywide, for example, to unobtrusively monitor the condition of various municipal resources, such as garbage bins and lampposts.

While privacy and authenticity of such crowd-sourced data are important issues that must be addressed, mobile and wearable-based analytics is well poised to have a major impact on the operation of future smart cities.

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