Mobile Phone CrowdSensing – A resource for Contextualized urban smart cities

We are 21st-century citizens, doing our very, very best to interact with 19th century-designed institutions that are based on an Information technology of the 15th century », Pia Mancini, 2014.

High rise of urban population and advancement in technologies demands the need for smart urban cities. Smart city uses information and communication technologies (ICT) to increase operational efficiency, sharing of the information with public and improving the quality of government services and citizen welfare. Smart cities use a combination of Internet of Things (IoT) devices, software solutions and user interfaces.

How IoT is useful in making cities smarter?

IoT device is a network of connected devices – such as vehicles, sensors or home appliances. The way interaction between Web Pages (WWW) is Internet of Content, interaction between people (Social Media) is Internet of People, interaction between devices (or things) is Internet of Things. Here thing can be anything like machines, home appliances, cars, sensors, trash cans etc. Smart city concept uses IoT technologies with aim of Making better use of public resources, reducing the operational cost of public administrations, creating new opportunities and supporting better living.

How Mobile phone sensors are helpful?

In the last few years, Mobile phones, appliances, vehicles, and other types of devices have sensors in them. On the good side, world is getting interconnected every day by these sensors. A mobile device is used on daily basis with a high frequency. There can be various types of sensors installed on a mobile device, from accelerometer to gesture recognition sensors.

A US based study reveals that share of adults who owned smart phones increased from 35% to 85% in urban areas, this huge increment in usage of smart phones powers up the concept of Mobile Crowd Sensing. In this article, we briefly explain how it is useful in context of urban smart cities:

The users who use a smartphone use Mobile Crowd Sensing (MCS) as a new direction in the development of the Internet of Things. It takes the advantage of certain smartphone features such as Camera, temperature, GPS, and microphone to collect data from the environment. We first take a look at Pollution sensing and social sensing.

In pollution monitoring use case, sensors are installed at fixed place; they continuously sense the movement of vehicles and other polluting things around them. This is called Fixed Sensing. Sensors are in place, so they provide very accurate results but with high cost.

Coming to social sensing, Facebook, LinkedIn and Google+ and similar social networks has led to increment in awareness of the power of social elements into a variety of data- centric applications. Embedding sensors in these social networks to collect large amount of data for prediction and monitoring applications is a natural way to enhance the power of such social. Social sensing is qualitative but subjective.

In Mobile Crowd sensing, there is huge number of sensors, the location of sensors is not fixed. These sensors have relatively low accuracy as compared to pollution and social monitors. These sensors are used to acquire data about the user. The acquired data can be used in several applications such as determining mental health, overall wellness monitoring, noise monitoring, and eating habits of community.

Research Question: Is mobile phone sensing an effective solution to the aggregation of urban knowledge?

In urban Scale crowd sensing: a large number of individuals use their mobile devices to collectively extract and share information related to a certain phenomenon of interest. An experiment was done in France where Ambiciti application was used for urban scale experiment, which notifies the collective exposure to urban pollution, air and noises both. It notifies the user of overall exposure to pollution. A user gets notified whenever he or she uses loud voice. It suggests the user of alternate route options with comparatively less pollution than more polluted ones.

There are certain factors that affect efficient crowd sensing solutions in Ambiciti such as Battery Usage is critical factor on smartphones; Mobile OS is to be optimized for normal usage, but there are some OS limitations such as background and sleep mode, access to sensors and network interfaces and accuracy of locations.

There are certain challenges that obstruct the mobile crowd sensing such as: Some users do not wish to share their information, someone can send fake data and redundancy in results.

Conclusion

Mobile crowd sensing represents a very promising approach for mobilization of citizens in order to improve and adapt their urban mobility. Crowd sourcing dynamic geographic information has potential to improve various aspects of urban life and urban mobility. We focus on probably the most prominent domains such as traffic, air quality and citizen activities on the move that have the great impact on mobility and city dynamics.

When Crowd Sensor meets the infrastructure IoT: Crowd Sensing has emerged as a powerful solution to address environmental monitoring, allowing us to control air pollution levels in crowded urban areas in a distributed, collaborative, inexpensive and accurate manner. Currently a lot of research is going on in this field and this would come out to be a game changing field in context of urban smart cities.