Smart Cities for the Rest of Us

Miguel Ángel Ylizaliturri-Salcedo[1], J. Antonio García-Macías[2(✉)], Raúl Cardenas-Osuna[3], and Leocundo Aguilar-Noriega[1]

[1] Faculty of Chemistry Sciences and Engineering, Autonomous University of Baja California, Tijuana, B.C., Mexico
{mylizaliturri,laguilar}@uabc.edu.mx
[2] Computer Sciences Department, CICESE Research Center, Ensenada, B.C., Mexico
jagm@cicese.mx
[3] Change Agents Society, Tijuana, B.C., Mexico
info@torolab.org

Abstract. More than half of the world's population live in cities. Smart cities could help to solve the present and upcoming problems that affects the people's well-being. However, developing regions face big challenges, like fighting poverty, jeopardizing the smart cities adoption. In this paper, we propose to design technologies for the problems of our developing regions. We describe our current work, designing and developing a wearable device for measuring poverty trough the analysis of social interaction and outlining its evaluation in the neighborhood of Camino Verde in Tijuana. We conclude by discussing our vision on the importance of designing technologies for our specific problems, culture and way of life.

Keywords: Smart cities · Poverty measurement · Wearable computing · Developing countries

1 Introduction

According to a recent UN report [11], from the current 7.2 billion people world's population, more than half lives in cities, and most of the future growth will occur in the less developed regions. However, urban growth, if well planned, has the potential to improve the people's well-being and managing environmental impact. Indeed, the welfare of the present and future population on the developing regions is a world concern, pointed already in the UN millennium goals [12]. In this scenario, the smart city is a way to achieve it. However, transiting to living in smart cities heavily depends on a costly, highly technified horizon, where both citizens and infrastructure are always connected to the Internet.

In this paper, we first present our vision about how smart cities must become more inclusive. Later, we propose the design of wearable technology for measuring poverty as a complementary mechanism to surveys and census for both, gathering data and empowering citizens on developing regions. Finally, we point to our conclusions and outline our future work.

E. Sucar et al. (Eds.): AFI 2016, LNICST 179, pp. 8–11, 2017.
DOI: 10.1007/978-3-319-49622-1_2

2 Smart Cities in the Context of Developing Countries

When thinking about Latin-American smart cities, there are a few examples besides capital cities such as Santiago, Mexico City, Bogota, Buenos Aires, and Montevideo, or the recognized efforts of Rio de Janeiro, Curitiba, Medellin or Guadalajara. We observe that this development is being centralized and the progress remains exclusive of just a few regions. With this in mind, we ask ourselves: what is happening with the rest of the region? Which are the opportunities for a city like Oaxaca or Tijuana to being smarter?

We consider that it is not enough to adopt pre-packaged "one size fits all" technologies or replicating developed country models, as they do not realize that each region, and each city, has its particular shape, geography and culture. It is necessary to recognize that becoming a smart city means so much more than creating costly infrastructure [5] to score satisfactorily on the international standards checklists [8]; remarking that our communities have also higher priorities, like fighting poverty, or achieving universal education, and other complex tasks that are still far from being realized.

We strongly believe that answering our questions must be done consciously, gaining knowledge from the city itself, with the participation of the more disadvantaged side of society: those who suffer from the more imperative situations, like poverty. We need to find out not only how to transfer the technology of the developed countries to the cities that need to get smarter, but also to create the appropriate technology for them. We think that this task should also empower citizens to solve their specific neighborhood problems, resulting in improving directly their quality of life.

3 Designing Around Poverty

Poverty is a multidimensional social phenomenon widely spread on the world, especially severe in developing countries. At least in Mexico, three dimensions are used as poverty indicators [6]: the net income compared to a "poverty line" (i.e. the minimum amount of money enough to pay housing, transport and feeding), the access to social services welfare (i.e. education, health, housing, utilities, social security and feeding) and the social inequality.

In the concrete case of Mexico, according to [4], 45.5% of the Mexican population live in poverty conditions. From Mexico's 117.3 million habitants, 41.8 million are living on moderated poverty and 11.5 million on extreme poverty.

Poverty measurements are made typically through census and surveys, resulting in composed welfare indexes. However, obtaining this data and turning it into information is costly, and the periodicity of these studies is relatively low. It is a fact that governments require poverty measurement data in order to identify priority themes, and to establish focalized programs and actions for guaranteeing social and economic development.

4 Measuring Poverty

Eagle et al. [7] showed that the diversity on social ties could be a proxy for measuring the economic well-being of a region. They shaped contact networks, analyzing the source and destiny of all the telephone calls in the United Kingdom and found that the social and spatial diversity between contacts correlate well with the United Kingdom's Index of Multiple Deprivation. Later, [9] studied 5 months of mobile phone data from Cote d'Ivoire, and proposed a linear regression model for estimating poverty, based on the traffic of phone calls between regions, diversity on calls and the introversion of the regions. In a further work [10] focused on the analysis of the mobile phone carriers antennas activity, rather than individuals calls, and they claim that their approach could provide a more detailed information on which specific zones suffers of poverty.

However, the aggregated data from telephone companies are essential for this kind of analysis and it is not always publicly available. The mentioned works also focused on the country or regional level, but do not provide answers at the community level, which is useful to describe how citizens suffer poverty and how their particular problems could be addressed. These works collect data using opportunistic sensing, and we aim to find out how appropriate it is to follow a participatory sensing approach. We are not aware of previous attempts to do this, but we think that a good starting point is to take clues from the sociometer device experiments proposed by [3].

4.1 Reinterpreting the Sociometer

Our idea is to develop a small, portable, and inexpensive device, composed with the necessary sensors to acquire data related to mobility and human interactions. Some of the parameters to be sensed (either directly or inferred) include proximity to others, orientation, and geographical position. Currently we are designing and testing our first laboratory prototypes using the ARM mbed IoT Device Platform [1]. Our approach follows user-centered design techniques, informed through interviews with our stakeholders, as well as participatory and non participatory observation for generating our next prototypes. The form factor for such device should be wearable, in order to be able to carrying it in a keychain ring, using a necklace or maybe incorporated in the design of community clothes.

For designing and testing our device, we closely collaborate with the Agents of Change Society at their project headquarters, the Transborder Farmlab [2], located in the neighborhood of Camino Verde in Tijuana. Camino Verde is a community of about 45,000 individuals, where near to 70% of the families living there are headed by single mothers. Camino Verde was previously known as one of the most dangerous neighborhoods of Tijuana, with the higher indexes on alimentary poverty on the city, suffering also of insecurity and the lack of public services. The Transborder Farmlab opened in 2012 as a community space, where workshops, artistic events and sustainability projects are developed, for empowering citizens to create ideas for increasing their own income and shaping a better quality of life.

5 Conclusions and Future Work

We strongly believe that the smart city discourse would be enriched when it focuses on proposing and designing technologies for the specific problems of developing countries, some of which do not exist or do not affect in the same way the developed countries.

We consider that designing with low cost in mind, should make the transit to the smarter city easier for our developing regions, recognizing our own culture and way of life. We are currently on the stage of designing and testing laboratory prototypes for supporting our wearable device concept. We plan to utilize user-centered design techniques for generating our final prototypes and developing a study into the wild for assessing its usability and utility with the help of the Camino Verde neighborhood community.

We aim to show if our proposed focus would offer new tools for gathering data related with the poverty phenomena and at the same time, to empower citizens' participation. We believe that these tools are essential when deploying smart cities technology in our development regions.

References

1. ARM mbed IoT Device Platform. http://www.mbed.com/en/
2. Cárdenas Osuna, R.: El laboratorio de la granja transfronteriza. Letral, pp. 138–151 (2011)
3. Choudhury, T., Pentland, A.: The sociometer: A wearable device for understanding human networks. In: CSCW 2002 Workshop (2002)
4. Consejo Nacional de Evaluación de la Política de Desarrollo Social, Informe de pobreza en México, 2012, México, DF (2013)
5. Center for Urban Innovation at Arizona State University, Smart cities financing guide: expert analysis of 28 municipal finance tools for city leaders investing in the future, Arizona (2014)
6. Diario Oficial de la Federación, Lineamientos y criterios generales para la definición, identificación y medición de la pobreza. 16 de junio de 2010. México, DF (2010)
7. Eagle, N., Macy, M., Claxton, R.: Network diversity and economic development. Science **328**(5981), 1029–1031 (2010)
8. ISO, ISO 37120:2014 Sustainable development of communities indicators for city services and quality of life (2014)
9. Smith, C., Mashadi, A., Capra, L.: Ubiquitous sensing for mapping poverty in developing countries. In: In Data for Development: Net Mobi 2013 (2013)
10. Smith, C., Mashadi, A., Capra, L.: Poverty on the cheap. In: Proceedings of the 32nd Annual ACM Conference on Human Factors in Computing Systems - CHI 2014, pp. 511–520 (2014)
11. United Nations, Concise Report on the World Population Situation in 2014, New York (2014)
12. United Nations, Millennium Development Goals and beyond 2015. http://www.un.org/millenniumgoals/