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IoT for a Better City - Porto Digital's Connected Urban Objects Lab (L.O.U.Co)

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EXECUTIVE SUMMARY

This paper presents the conceptual model for Porto Digital's Connected Urban Objects Laboratory (L.O.U.Co), a lab dedicated to the conception, development and prototyping of Internet of Things (IoT) solutions addressing wellness in urban environments. Within are detailed its mission, strategies, implementation plan, structure and objectives. The lab is Porto Digital's main strategy to address the concept of the IoT, both as a set of technologies, business opportunities and social impact possibilities. The lab, which will be fully functional in late 2015, will use a discipline from the Universidade Federal de Pernambuco's Computer Science course as a bridgehead to generating IoT startups that will ultimately develop solutions for cities. The lab will be open, free-to-use and fully equipped with sensors, actuators, softwares and hardware necessary to the development of these solutions. The lab will also serve as a testing ground for established companies aiming to create new solutions using IoT.

1. INTRODUCTION

It's time to hack the city. According to a 2014 United Nations (UN) report[1] , 54% of all human beings live in urban areas. That same report states that by 2050, the percentage of urban dwellers will grow to 66% - with an average of 80% of the Western population projected to be urban by that same year. Such population growth won't come without several challenges, both in terms of infrastructure, services, management, and economy, but most fundamentally, the very notion of wellness. The most important question for future urban populations is whether life will be joyful, sustainable, if cities and its citizens will live in harmony with the rest of nature, delivering the full potential offered by the future.

But what's the shape of the future? According to several consultancy firms, the future is one big, overcompassing, hyperconnected world of objects consuming, generating and sharing exabytes of data with other objects and people. That's the Internet of Things (IoT), a concept first proposed by British Massachusetts Institute of Technology (MIT) professor Kevin Ashton in 1999, which involves the notion of regular objects, say furniture, clothes, vehicles, etc., being given "intelligence" through layers of software, connectivity, sensors and automation. According to IDC[2] , by 2020, the Internet of Things (IoT) will comprise some 200 billion objects, generating US$ 1,9 trillion in revenue. Some predictions are even bolder, stating that by the end of the decade the number of connected things will pass the trillions mark.

Combining the need to find new solutions for ever-growing, faster-than-ever problems due to urbanization, with trillion-dollar market that might change the face of society even faster than the internet of people, Porto Digital decided to create a laboratory fully dedicated to the exploration of IoT solutions for cities.

The L.O.U.Co – Portuguese acronym for Connected Urban Objects Laboratory and an intentional pun with the Portuguese word for "mad", as in "mad professor" – has as its main goal to be an environment for developing, testing and prototyping solutions that address wellness in cities and of its citizens using IoT Technologies – sensors, actuators, microprocessors, software and internet.
The lab is expected to be fully functional by the end of 2015 at Porto Digital's creative economy unit, Portomídia, in Recife, Brazil. Following the park's approach to the Triple Helix model, proposed by Etzkowitz[3] , the L.O.U.Co will be fully integrated with Universidade Federal de Pernambuco's (UFPE) Computer Science department, municipal and state governments and also with the market.

This paper will present the conceptual model for the L.O.U.Co, - its vision, strategies, implementation, structure, challenges and objectives.

2. PORTO DIGITAL

The main "hotbed" of knowledge and development of ICT applications in Pernambuco is the Porto Digital (PD). This it is a technology park located in Recife historic center. Porto Digital is the result of the innovation environment that was consolidated in Pernambuco in the last decades along with the coordinated effort of the university, the productive sector and government, with the aim of entering the Information and Communication Technology industry in the economic matrix of the State of Pernambuco. Industry growth potential, ICT

1. World Urbanization Prospects: The 2014 Revision - http://esa.un.org/unpd/wup/Highlights/WUP2014-Highlights.pdf
2. IDC - Internet of Things 2013–2020 Forecast: Billions of Things, Trillions of Dollars
3. ETZKOWITZ, H. Hélice Tríplice: Universidade – Indústria – Governo Inovação em Movimento. Porto Alegre: Edi PUCRS, 2009. 207 p.

is also the basis for the increased competitiveness of a region in any strategy of contemporary economic development.
Its goal is to implement public policies for economic development of the State, urban regeneration, social inclusion, strengthening the ICT hub and other clusters through the use of these technologies. In 14 years of existence, Porto Digital (PD) is a leading technology hub in the country. The park has already generated for the state 7,100 jobs, attracted 536 entrepreneurs and 240 institutions including universities, governmental agencies, research and development centers and national and international technology companies as illustrated in the Figure 01.

As a result of its actions, in 2005, the international consultancy, AT Kearney[4], classified Porto Digital as the largest technology park in the country, and a national benchmark in using public policy to promote innovation and strengthen the technology sector. In 2007 and in 2011, the National Association of Organizations Promoting Innovative Enterprises (Anprotec)[5] considered PD the best technology park/ habitat of innovation

Figure 01 – Porto Digital´s environment

in the whole of Brazil.
In 2008, the International Association of Science Parks and Areas of Innovation (IASP) published the first volume in the Learning by Sharing series, in which it highlighted the case of Porto Digital, along with three other science parks in Malaga (Spain), Manchester (UK) and Hyderabad (India). Also in 2008, the Brazilian Ministry of Development, Trade, and Industry recognized Porto Digital as the Cluster of Information and Communications Technology of Pernambuco.
In 2009, a report published in the online edition of Business Week mentioned Porto Digital as one of the most innovative technology parks, listing it as one of the ten places in the world where the future is being created. More recently, McKinsey singled out Porto Digital, along with the Campinas Region, in the State of São Paulo, as the two centres for innovation with the greatest potential for generating business in the technology sector in the country.

4. AT KEARNEY. Desenvolvimento de uma Agenda Estratégica para o Setor de “IT Off-shore Outsourcing”. Brasília, 2005
5. ASSOCIAÇÃO NACIONAL DE ENTIDADES PROMOTORAS DE EMPREENDIMENTOS INOVADORES. Panorama de Incubadora de Empresas e Parques Tecnológicos 2006. Brasília> ANPROTEC, 2005. Disponível em < http://www.anprotec.org.br/ArquivosDin/Panorama_2005_pdf_11.pdf> Acesso em 29 de junho de 2009. 15:32:57

In 2012, the park won from INPI - (National Institute of Industrial Property), the first Seal of Geographical Indication in the area of IT services. The seal certifies that the software produced in the Porto Digital has a quality certificate.
In 2013 BBC presented Porto Digital as a great tech hub away from the Rio-São Paulo axis that has a great success. In the same period, Financial Times Special Report titled “Brazil Innovation, Research & Development” highlighted Porto Digital’s history and activities as a great example for the special report.

In the same year, Porto Digital hosted the 30th IASP World Conference and the XXIII Anprotec’s National Seminar. The events occurred jointly between 14th and 17th October, under the organization of Porto Digital. The event whose theme was "Science Parks Shaping New Cities" featured about 1,150 participants from 47 countries, of which 85 were speakers. In this event, the Porto Digital Incubator, C.A.I.S. do Porto, was elected by Anprotec, through the Innovative Entrepreneurship Award, as the best incubator in the country facing oriented local development companies.

In 2014, another Financial Times Special Report highlighted Porto Digital again. With the title “Latin America’s Regions – Doing Business in Brazil’s Northeast”, the text makes reference to Porto Digital as a project not only designed to stop the city’s brain drain but also to create an economic model based on information and knowledge.

In that same year, the business magazine Exame, nationwide, based on research by consultancy Urban Systems, highlights Porto Digital as one of the main factors that makes Recife one of the best cities in the country (10th ranking) to doing business, placing it among the elite in the cities of Brazil in the economy competitive and enjoyable for residents.

Months later, Porto Digital was cover story in the magazine of TusPark, a Chinese Technology Park. The article wrote abut the glorious history of PD establishment at initial stage, and development in the past two years with relevant limitations PD faced.
To manage the park, it was created in 2001 the NGPD – Porto Digital Management Unit, a social, private and nonprofit organization. This organization has a role in the success of Porto Digital. NGPD is the agent for implementation of public policies to promote the structure and Technology Park evolution , through the implementation of public and private resources.

NGPD’s main objective is to increase the positive environmental factors in order to improve the innovative capacity and enterprises and cluster competitiveness as a whole. To do this, its main roles are: (i) to generate original ideas, (ii) to develop innovative projects from original ideas, (iii) to joint operating agents, so that projects can be implemented including sponsors, government, enterprises, universities, and (iv) to attract innovative ICT-based companies.

Given the above, it is understood that PD is a valuable asset of Pernambuco state, with the potential to contribute to improve standards of production efficiency in the ICT sector and therefore to improve the level of the park business development and competitiveness.
This indicates that there is great potential to improve competitiveness through strategies from the park management and, consequently, from the technological and innovative region development.
In order to share its experience in the Technology Park management that is evolving every day more, NGPD established key points listed in Porto Digital’s management, which contribute to building a favorable socio-economic development of the region's environment, providing new ventures attraction, skilled jobs creation and higher income. These points will be addressed in the next sections of this document.

3. L.O.U.Co

The Connected Urban Objects Lab – L.O.U.Co - is Porto Digital's first attempt at establishing itself as a center for Internet of Things (IoT) solutions. It'll be an open, free-to-use, innovation-focused laboratory dedicated to solving problems of the urban environment. Specifically, the lab was designed to be a space where students, entrepreneurs and hackers may experiment, develop and prototype solutions addressing the wellness and well-being of citizens and cities, using sensors and actuators, mobile apps, internet and analytics. Among the goals and activities scheduled for the L.O.U.Co, are:

- Promoting entrepreneurship and innovation among IT graduate students
- Promoting hackathons and makerthons using IoT technologies
- Using IoT to address themes like wellness, healthcare, sports, environment, transportation, mobility, culture, entertainment, urbanism, etc.
- Development and incubation of startups delving in those themes using IoT
- Promoting workshops about IoT and the aforementioned themes
- Establishing partnerships with IoT companies, labs, science parks and municipalities interested in solving urban problems with sensors, actuators and software

The lab will initially occupy an area of about 20 square meters (aprox. 216 square feet) in Porto Digital's creative economy facility Portomídia. Construction of the laboratory is expected to begin in late 2015. However, Porto Digital already plans to expand the laboratory, and more than triple its size in the next two years. The final version of the L.O.U.Co will be a 65 square meters (aprox. 700 square feet) laboratory and will he located at Portomídia's new production facility – a mix of incubator, laboratories, co-working space, events center and digital arts gallery at the heart of Bairro do Recife. In both versions, the lab will be equipped with a full library of sensors – accelerometers, motion sensors, chemical sensosrs, etc – Arduino boards and other robotics components, softwares and also with smart fabrics and the latest wearable products, like smartwatches.

But it's the people who are expected to be the greatest asset in this initiative. The program for the L.O.U.Co has as its primary target students of the Universidade Federal de Pernambuco's computer sciences department, the Centro de Informática (CIn). One of CIn's most famous and important disciplines, the Development Project – or as it is most famously known, the "Projetão", or Big Project – will serve as a bridgehead between academia and the market in this new, trillion-dollar market called IoT. In the Projetão, students are asked to form teams of about five people, identify a problem that could be solved with software applications and develop it. But not only that: students are also encouraged to build business plans for their solutions and see if their ideas are marketable.

One interesting fact about the Projetão is that, although CIn coordinates it, it is not limited to computer science students. Students of Design, Communication, Biology and Engineering are commonly part of Projetão's teams, making it the most interdisciplinary discipline in the university. And according to CIn's directors, about 30% of of all Projetão's projects end up developing into startups. That percentage might seem high, at first, but to Porto Digital, the number of startups coming out of Projetão could not only be higher, but also more directed at new, cutting edge technologies.

So, in partnership with CIn, Porto Digital proposed a sponsorship of sorts, to make the students design and develop solutions to solve problems typical of the urban environment. The plan is to keep students free to decide which problems and areas they'll attack and which technologies they'll use. But they'll also be stimulated to solve wellness, mobility, infrastructure, health and other problems typical of the urban environment, using technologies and concepts used in the IoT field. Porto Digital will propose a number of

themes and problems – i.e. waste, river pollution, traffic, etc – and those teams that accept the challenge will have full support to develop that solution. The support includes:

- Access to the L.O.U.Co, its equipments, softwares and hardwares
- Mentoring with experts in IoT, software, design, engineering, etc
- Access to fast prototyping tools, like 3D printers
- Access to subsidized prototyping services for miniaturization and full prototyping

That way, Porto Digital believes it'll be possible to build mature solutions that might, once Projetão is over, be turned into IoT startups that'll enter a business cycle guided by Porto Digital. This cycle includes a pre-incubation phase in which students will have yet another opportunity to deepen their knowledge, test the feasibility of their solution and check if that makes sense as a product. These early startups, then, may be included in Porto Digital's incubation program. Today, the science park holds two incubators, one for pure IT solutions and another for the creative industries. After 18 months of incubation, these startups will also have the opportunity to enter Porto Digital's business acceleration program, through the Jump Brasil accelerator – a program that includes not only mentoring, but also funding. Finally, these startups may end up being fully embarked in Porto Digital, with access to its education and tax exemption programs, and also to the unique business network and environment of Porto Digital.

With this, Porto Digital believes it'll be possible to generate 24 new IoT-focused startups in the lab's first 18 months. And since the problems identified by these students are ultimately every city's problems, Porto Digital believes it's possible to export these solutions and apply them throughout the world. From air and water quality to the flux of people and cars, from smartgrids to health trackers, from public electronic assistants to e-gov, from augmented reality to micro weather monitoring - everything and anything that makes life a little better in cities will be developed inside the L.O.U.Co.

But not only that. The activities in L.O.U.Co's facilities will also support established businesses inside and outside Porto Digital. The lab will be open and free-to-use for those companies already associated to the park. There, they'll also be able to use the lab's space, computers, softwares and hardwares to experiment and develop any solution. From apps designed for smartwatches to drones and smart things, everything and anything might be developed inside the lab. Non-member companies will also be allowed to use L.O.U.Co's facilities, but will be asked first to submit a project for consideration. The goal is to turn these projects into new products and startups that may eventually enter Porto Digital's business cycle – from incubation, to acceleration, to embarking. The objective is to have 12 companies, inside and outside the park, using the lab in its first 18 months.

One final line of action focused on businesses is the promotion of three hackathons/ makerthons. In a similar way to the Projetão, Porto Digital will challenge established companies to solve one specific urban problem identified by local governments and NGOs. Theses companies will also have full access to L.O.U.Co and its equipments. The best solution may win a contract to develop and apply the solution in Recife. It's also in Porto Digital's plan to hold three workshops focused on IoT technologies to build better understanding of the possibilities and potential of these tools.

4. CONCLUSION

Since IoT is expected to chance society faster and deeper than previous technologies – that is, the personal

computer, then the internet and finally smartphones – it is fundamental that companies and the public sector begin to delve into these technologies now if they want to stay competitive and relevant in this new market.
Also, Porto Digital believes that with L.O.U.Co it'll be possible to achieve three goals with one single inniciative: to stimulate academic knowledge, foment new technology-focused businesses and contribute to the betterment of society through promotion of wellness in urban environments. Theses goals are not coincidental. They're rooted in Porto Digital's approach to the Triple Helix model, with academia, market and governments working together to develop a more competitive environment that'll end up raising local social structure.

The lab is one of Porto Digital's key strategies for the next five years and will probably develop into new ways of looking at the park's role in its ecosystem. In the end, the L.O.U.Co will extrapolate the walls of its facilities and spread itself to the builds and streets of Porto Digital's whole territory, something that is aligned with the park's tradition of being one big open laboratory for social and technological innovation.