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PROPOSAL FINAL PROJECT for INDUSTRIAL ENGINEERING MASTERS

(8 February 2019)

Two proposals for final projects for Industrial Engineering Masters are described in the following pages considering the next characteristics:

MAIN CHARACTERISTICS

CONJOINT PROPOSAL	1) Prof. Javier Faulin. Institute of Smart Cities- Public University of Navarre. Pamplona. Spain 2) Prof. José E. Ramírez-Márquez. Systems Development & Maturity Laboratory. Stevens Institute of Technology. Hoboken. NJ. USA.
LANGUAGE	English- Level B2 or C1
REQUIREMENTS	1) Basic knowledge of Logistics and Operations Research 2) Basic knowledge of statistics and data analysis using R / Excel.
PROPOSAL DETAILS	These two proposals are offered in a conjoint way by Prof. Javier Faulin (http://www.unavarra.es/pdi?uid=2059) and Prof. José Ramírez-Márquez (http://personal.stevens.edu/~bsauser/SysDML/Ramirez-Marquez.html). The main information describing the two proposals are centered in the research done by Prof. Ramirez-Marquez with data given by the Stevens Institute of Technology. These two proposals includes the actions: a) The project will be prepared with the data and information provided by the Stevens Institute of Technology in the period March-June 2019. b) During the months March-April 2019 periodical Skype meetings with Prof. Ramirez-Marquez will be organized to plan and discuss the topic to develop as a final project c) During the months May-June 2019 the project students should visit the New York city and the Stevens Institute of Technology to develop and conclude the project under the Prof. Ramirez-Marquez's advice. d) This final project has to be registered and presented at UPNA

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Optimizing Bicycle Sharing Stations

Introduction

It is projected that by the year 2050, 70% of the world's population will be urban, with more than 200 cities around the world. With a rising population an increase in transportation services is eminent, which in turn has positive and negative consequences attached to it. Thereby many cities have been focusing on reliable and sustainable forms of transportation. Bicycle sharing systems are becoming popular, as they can solve the problem of small commutes, they are faster than walking and do not produce any pollution; plus who wouldn't prefer riding through the streets than being stuck in at a traffic congestion in a crowded bus or train?

Nonetheless, bicycle sharing systems have flaws, such as running out of docking spaces or running out of bicycles, causing rider's dissatisfaction. Decision-makers then face several question, such as how could those bicycles be distributed amongst docking stations in an optimal manner? How about opening new docking stations; where should these new docking stations be placed to optimize user satisfaction at most times of the day? All these questions, and more, can be approached through optimization and re-balancing algorithms targeted at bicycle sharing stations. Different techniques have been developed [1,2,3,4,5] but they are either case specific, or based on the structure of the network, or the prices of the service, or even the inventory control of the bicycles to comply with user satisfaction.

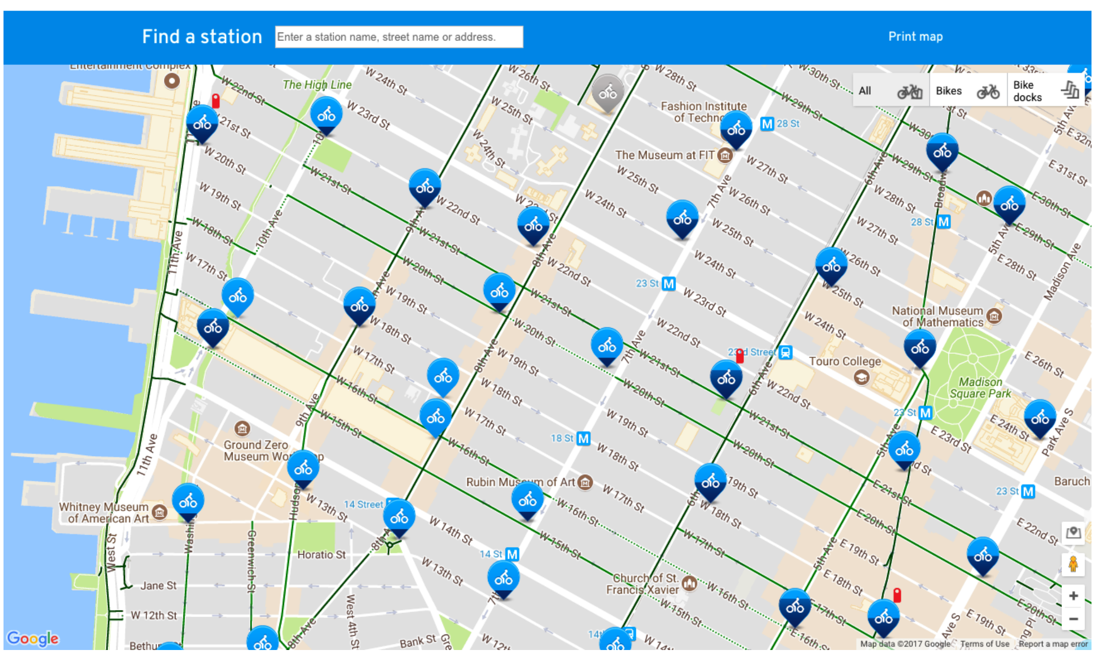

Figure 1: Citibike. Bicycle sharing system in New York City.

Project Definition

The main purpose of this project is to develop a method for optimizing bicycle sharing systems based on docking station's behavior.

Possible steps to follow:
1) Research current optimization methods for transportation systems and in particular bicycle sharing systems.
2) Analyze and understand the existing data of Citibike.
3) Develop a method for optimizing and rebalancing bicycle sharing systems based on the data provided by Citibike.
4) Test out the method.
5) Obtain data from other bicycle sharing systems for comparison and validation purposes.

References

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[2] Lin, Jenn-Rong, Ta-Hui Yang, and Yu-Chung Chang. "A hub location inventory model for bicycle sharing system design: Formulation and solution." Computers & Industrial Engineering 65.1 (2013): 77-86.

[3] Rainer-Harbach, Marian, et al. "Balancing bicycle sharing systems: A variable neighborhood search approach." European Conference on Evolutionary Computation in Combinatorial Optimization. Springer, Berlin, Heidelberg, 2013.

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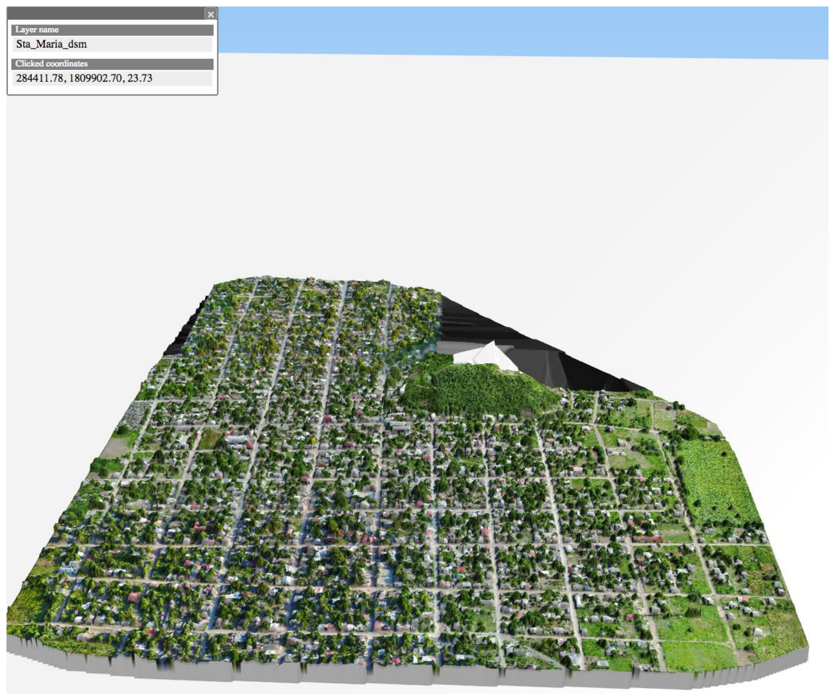
[6] https://www.citylab.com/transportation/2015/02/amsterdam-has-officially-run-out-of-spaces-to-park-its-bicycles/385867/

[7] https://www.nytimes.com/2015/09/21/nyregion/bike-sharing-programs-gain-a-toehold-in-new-jersey.html

Drones & Damage Assessments

Introduction

After the September 2017 earthquakes in Mexico there is a grand need of verifying the information of the affected area. The magnitude of the disaster bypassed the government capacity to assess damages. For deploying first aid help governments and NGO's need information of the disaster affected area. National data is not updated every year nor is adequate at a lower scale level. This information is not the best for defining losses and damages but is the only information government and ONG´s have. Information uncertainty hinder disaster relief attention and could generate corruption problems. In Japan after the 2011 earthquake and tsunami big data generated by mobile phones gave a more accurate measure of the population affected by the disaster, demonstrating a 25% difference between government statistical information and real time data[1].



Map of Santa Maria, Oaxaca . CENAPRED (2017)

Alternative data sources for disaster relief have been explored to provide new possibilities to characterize human behavior during critical events. This alternative data sources come from social media (twitter and facebook), aggregated and anonymized Call Detail Records (CDR)

[1] http://www.nhk.or.jp/datajournalism/about/index_en.html

captured from the mobile phone infrastructure, mobile phone data (SMS, and calls), drones and satellite images [5]. Tagging images can be done with crowdsourcing to identify affected areas. Such efforts has been done by Humanitarian open street maps (HOTOSM) to create maps with satellite images where the information is missing, there is an area of opportunity with creating this maps with drone images since they have better resolution.

Project Definition

The objective of this project is creating a crisis map with drone images that help policy makers visualize and identify the most affected areas in case of a disaster in a prompt matter.
Activities:

1. Literature review
2. Damage identification and best practices for visualizing disaster response
3. Design pipeline for ingest the drone images
4. Automatize generation of the map (3js)
5. Crowdsourcing platform for identifying damages or automatize damage tagging

References

[1] Pastor-Escuredo D., Morales-Guzmán, Rutherford A., et al,(2014) Flooding through the lens of mobile phone activity, Global Humanitarian Technology Conference (GHTC), 2014 IEEE.

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