A Geo-collaborative Recommendation Tool to Help Urban Mobility

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Abstract. Geo-collaboration appears when individuals or groups work together to solve spatial decision-making problems facilitated by geospatial information technologies. In this paper we focus on current developments in geo-collaboration to help urban mobility. This work shows a collaborative mobile prototype that help people to take some decisions and share knowledge from a city. The main prototype recommends a better route to users in order to promote "walkability", in our case, Mexico City. The system not only takes on account the user profile, but the time, the date, the recommendation of other users and their spatial activity in order to give the best route.

Keywords: geo-collaborative, urban mobility, recommendation, user interface contextual design, "walkability".

1 Introduction – Urban Mobility

The past fifty years has been characterized by the explosive growth in urban sprawl and car use. Urbanization is now heavily influences by car and many households have moved out to the green suburbs and need several cars to satisfy their mobility needs. The resulting consequences of this urban sprawl are well known: the degeneration of social and neighborhood links, grater car dependence, longer journeys and increased transport costs.

Those cities that have been able to keep historic center, and maintain their commercial and cultural activities, are now threatened by the unsustainable growth of traffic and congestion. Interurban journeys are becoming quicker but cities themselves are being almost paralyzed by traffic. Unrestricted car use in towns and cities has a negative economic impact on efficiency, uses non-renewable energy sources, contributes to the greenhouse effect and their citizens suffer from high levels of noise and pollution.

Citizens today realize that their future, and that of the next generations, depends on the decision made by politicians responsible for urban planning and the mobility measures put in place by them. To ensure access to all the activities on offer, even for those without a car, and still respect the environment, car use in cities must be mastered and priority be given to public transport, pedestrians and cyclists – all measures which will improve the quality of life in urban areas.

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We are all pedestrians. Walking is the most natural way to move, but requires not only legs. Requires "walkable" streets. A good walking environment has to protect pedestrians of the motorized vehicles. The speeds of circulation must be drastically reduced with free obstacles and well-illuminated sidewalks. The speed of the cars it must be reduced in the crossings streets with a good walking signals. This infrastructure must be accessible for all users, including people in wheelchairs and families with strollers. The pedestrian network must provide direct access to destinations, as schools, employment and transport stations, and it must offer diverse attractive and safe routes. The environment must be designed to attract the people who walk for pleasure safely.

With these precedents, it is important to use information technology to develop software applications in order to have a better "walkability" of the users in their environments (cities). The case of Mexico represents important "walkability" challenges and is highly contextualized.

In the next section some studies on urban mobility and geo-collaboration are shown. The section 3 we explain the designed recommendation tool with its different capabilities. The software prototype is also shown in section 3 with different interfaces. Finally conclusions are given with some further perspectives of the work in section 4.

2 State of the Art – Geo-collaboration and "Walkability"

Geo-collaboration is an emerging activity where users explore geospatial information through geo-referenced information [1], [2], in order to solve problems requiring a workspace and location components to be represented. This form of collaboration can occur in both co-located and virtually distributed settings. These systems offer co-located virtually or co-located group spatial knowledge creation for decision-making and planning support, using geographic visualizations to explore the initial available information and view intermediate results. Geo-collaborative application have been used mainly to communicate planning scenarios [1], its system design include a digital workspace for map-based analysis and visualization, multimodal interfaces for allowing interactions between participant with various roles, and databases to provide baseline data and store new information.

The system described in [3] supports synchronous and asynchronous interaction among users working in different places, providing geo-referenced localization services. The system presented in [4] uses mobile devices to provide synchronous interaction among users located in different places; The application presented in [5] uses mobile devices to support synchronous and asynchronous interaction among users in various places. In [6] the authors present a system supporting synchronous navigation of distributed users in a virtual co-located space; [7] supports the synchronous visualization of social interactions located in the same workspace through co-located mediation.

In other hand, "Walkability" is the degree to which an area within walking distance of a property encourages walking trips for functional and recreational purposes [8]. Several physical and social attributes of an area can affect walkability including street connectivity, traffic volumes, sidewalk width and continuity, topography, block size, safety and aesthetics [8].

Three known tools that evaluate pedestrian accessibility and present so-called "walk scores", or walkability surfaces to the user are WalkScore.com, Walkonomics.com, and walkshed.org. The "walk score" indices calculate a score based on facilities, such as shops, parks, restaurants, etc., that can be found within a certain distance from an

evaluated location. Walkshed.org's "walkability surface" lets users select and prioritize a number of indices that are then used to derive a heat map that highlights walkable neighborhoods. The approach used in WalkScore.com has been described in detail [9], whereas the methodology applied in Walkonomics.com is only outlined generally [10].

3 Contextual Study

Mexico City is singular and therefore has unique walkability problems. Mexico City is a city with a large population and different areas of the city have different problems. A contextual study is important to identify specific problems. Our contextual study focused on the west area of the city of Mexico, where there exists a significant social inequality and where walkability index changes from one area to another. We explain the two main problems found after the contextual study.

Insecurity is the biggest problem identified in the study. People do not walk as many times because they are afraid of being assaulted and always try to avoid certain dangerous streets or routes. This insecurity feeling expands all over a specific area and the result is that the people not walk. In figure 1 we show this problem.

In Mexico, the informal trade occupies the sidewalks. The sale of food, clothing, electronics and other products is tolerated by authorities and is a source of income for thousands of families in the country. However, the occupation of sidewalks by informal trade has a negative impact on the capacity and quality of service offered by this infrastructure on pedestrian circulation. Another problem is the lack of maintenance and pedestrian infrastructure. The next figure (2) shows this problem.

Fig. 1. Insecurity, the first contextual problem found

Fig. 2. Infrastructure and sidewalks problems

Having these two main problems in mind we have decide to promote and develop a recommendation tool in order to help people walk safely on streets with a minimum of problems due to infrastructure problems.

4 The Proposed Recommendation Tool

The developed prototype is a collaborative tool for sharing some interesting and important information about a specific location, in our case the west side of Mexico City. This prototype will allow sharing some spatial knowledge recommending some urban mobility tips that will help users that are interacting with the application. This capacity to move from one place to another is very important in the Mexican context.

The collaborative tool, aims to communicate with other users some experiences when the user is walking through an urban area. In Mexico City you can walk through a pleasant park and suddenly find an unpleasant experience due to traffic, the crime, or simply to find an infrastructure problems.

The regular users interact with the recommendation tool and share this knowledge generated in order to help and recommend some pleasant an unpleasant places to other users. With this tool, the users will move and walk around in a better way. Actually, the users that interact with the mobile application have the ability to qualify, report or recommend any site of interest. These elements, displayed on the map, will help other users to move in a more comfortable way in a specific area. These elements shows how safe is an area, the state of an existing infrastructure (lighting, bridges, streets), also the user can select and recommend some attractions (parks, zoo, museums, restaurants, street). The user may then recommend and select certain areas as satisfactory spots. Other users may have access to this information.

An important feature of the collaborative application is that the user can perform a custom search of the places he wants to find. This option can be generated using its unique location based on GPS location or providing textual information. The result will be an interactive map with the satisfactory and unsatisfactory elements.

The application returns 3 different routes in order to move from one place to another: 1) the fastest, which is the traditional result of any regular navigation system, 2) the safest, which verify check and will avoid the negative recommendations identified by other users, and 3) the most pleasant, which take into account the positive and negative recommendations to define the route. The user can, then, make their own decision based on their needs.

The model used for the construction of the prototype has 3 main modules. The first input module, where the user information is stored in a database (recommended positive and negative elements). The second is the query, where the user makes the recommendation request to move from one place to another. Finally the system will display the 3 recommended option to move. It is important to say that the system will verify also the transport network database and the video monitoring network. Ideally, the 3 different options will match. The model is shown in figure 3.

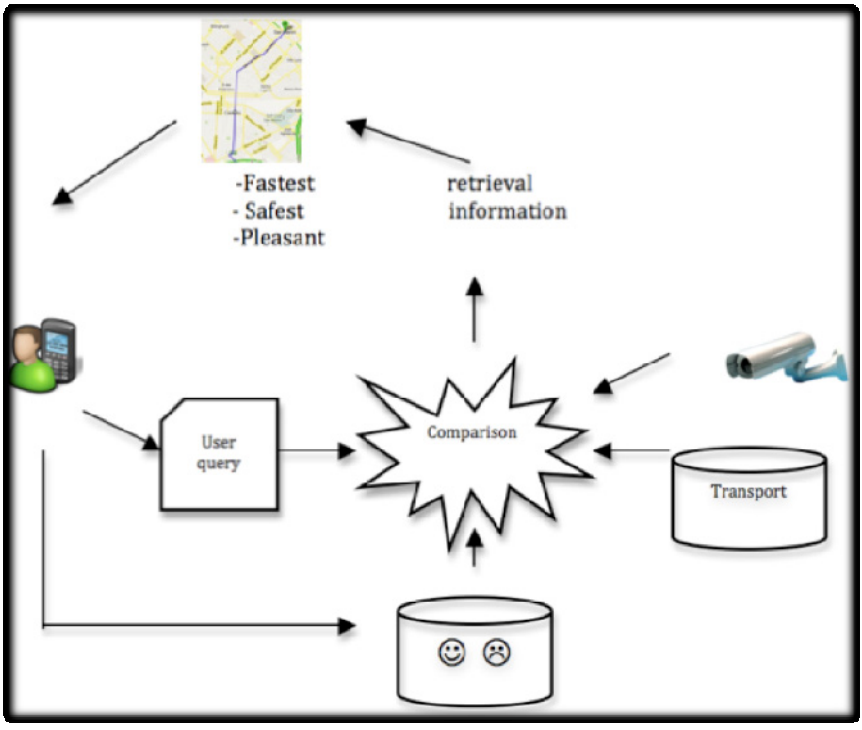

Fig. 3. Model of the recommendation tool

In the next figure (4) we shows several interfaces of the geo-collaborative tool. We show the interface where several users have reported a set of elements both satisfactory and unsatisfactory. The users that interact with the mobile application have the

ability to qualify report or recommend any site of interest. These elements, green and red spots, are emoticons on the map that will help other users to move in a more comfortable way in a specific area. The result of the query will be an interactive map having the three recommended routes (fastest, safest and pleasant). The user can choose the best route in an interactive map according to their needs.

Fig. 4. Infrastructure problems and sidewalks occupied

5 Conclusion

In this article, we have presented a recommendation tool adapted to Mexico City where users directly feed the system collaboratively. Users recommend positive and negative elements in an interactive map and use some emoticons. This information is consequently used to recommend a better way to move from one place to another based on three conditions (safety, fastest and pleasant).

The tools take into account the Mexican context, which is very similar to the Latin American context and other cities could adopt it. The tool can be very useful and help "walkability" only if recommendations are accurate. The tool will work in a better way if many users use it.

This paper presents the first prototype of the recommendation tool. Further work will be the implementation of the model and the construction of the real application. An evaluation of the application has to be made in order to propose some improvements. Finally a usability study of the complete system will be a priority in order to have better results.

References

1. Derballa, V., Pousttchi, K.: Extending knowledge management to mobile workplaces. In: Proceedings of the 6th International Conference on Electronic Commerce. ACM, Delft (2004)
2. Rinner, C.: Argumentation Mapping in Collaborative Spatial Decision Making. In: Collaborative GIS, pp. 85–102. Idea Group Publishing, USA (2006)

3. Convertino, G., Zhao, D., Ganoe, C.H., Liang, J.: A Role-Based Multiple View Approach to Distributed Geo-Collaboration. In: Jacko, J.A. (ed.) HCI 2007. LNCS, vol. 4553, pp. 561–570. Springer, Heidelberg (2007)
4. Bortenschlager, M., et al.: Towards a P2P-Based GeoCollaboration System for Disaster Management. In: GI-Days 2007 - Young Researchers Forum (2007)
5. Convertino, G., et al.: Comparing Media in Emmergency Planning. In: Proceedings of the 5th International ISCRAM Conference, Washington DC, US (2008)
6. Rinner, C.: Argumentation Mapping in Collaborative Spatial Decision Making. In: Collaborative GIS, pp. 85–102. Idea Group Publishing (2006)
7. MacEachren, A., et al.: Supporting Map-based Geocollaboration through Natural Interfaces to Large-Perspectives 54(1), 4–22 (2006)
8. Pivo, G., Fisher, J.: The Walkability Premium in Commercial Real Estate Investments. Real Estate Economics 39(2), 185–219 (2011)
9. WalkScore, Walk Score Methodology. WalkScore (2011), http://www2.walkscore.com/pdf/WalkScoreMethodology.pdf
10. Davies, A.: Walkonomics - How Walkable Is Your Street? About. Walkonomics - How Walkable Is Your Street (2012), http://www.walkonomics.com/w/index.php/about