Improving Mobility in University Communities Using a Collaborative Prototype

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Abstract. Mexico City is one of the cities with the highest vehicular traffic in the world. Santa Fe is a commercial and business zone located in the west side of this City. Also, three of the most important Universities in the country are located in this area (IBERO, UAM-C and ITESM). Santa Fe stands out as a particularly conflictive place in terms of vehicular traffic due to the high number of floating population, few access roads and non-connection with the massive public transportation of the City. This investigation analyzes the problem of urban mobility with an interdisciplinary approach. Some UX research methods were applied in order to identify the context and identify some interesting findings related with urban mobility. The main idea of this paper is the design of a digital tool only available for the University Community. It will be filled with information uploaded by the same Community. Through an APP, they will be able to visualize different options of routes and kinds of transport, also alerts and location. Everything is going to be modified and visualized in real time. This project will be a tool that will empower the University Community.

Keywords: Mobility · Traffic · Collaborative prototype

1 Introduction

Road congestion is one of the most common problems suffered by the major cities of the world, this problem has worsened in different parts of the world and has reached extreme levels that seriously affect the quality of life of the citizens. Aspects such as environmental, economic, health or insecurity are affected because of mobility problems in these cities, which involve private cars and the transportation system alike.

Studies such as the published by INRIX Global Traffic Scorecard in 2016 [1] show the complexity of the problem of mobility and traffic in certain cities, for example, it indicates that the inhabitants of the city of Los Angeles, in USA, spend 104.1 h a year stuck in traffic.

Other cities within the count made by INRIX are Moscow, with 94.1 h in traffic, New York (89 h), San Francisco (82.6 h) and Bogota (79.8 h), Mexico City has a calculation of 61.5 annual hours that its citizens pass in traffic.

On the other hand, TOM TOM TRAFFIC INDEX 2016 [2] places Mexico City first in its ranking where it calculates the "extra time" that is consumed in a route due to

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road congestion compared to the same route with clear roads, and in Mexico City the time on the road increases by 66% extra due to congestion.

Different actions have been taken to try to solve a problem that has gone out of control since a couple of decades, these initiatives range from imposing taxes on fuels, recovering public space to give priority to pedestrians and alternative ways of transportation or expanding the public transport offer.

While some of these actions have had a positive effect on reducing the mobility problem and the effects it entails, there is still a long way to go to achieve efficient mobility, especially in some cities where government policies and infrastructure are not enough. For this reason, we can see that Universities, Organizations and the private sector are developing new plans to improve mobility.

Gradually people begin to take actions in their hands to solve the problem of mobility and begin to organize with other citizens, therefore, it is necessary to expand the range of platforms and tools that give greater strength to these actions.

This paper presents the process of research, methodology and proposal of a digital tool that finds its main strength in the collaboration between users to solve the problem of mobility in one of the most conflictive points for mobility in Mexico City, Santa Fe.

2 Mexico City: A Big City

Santa Fe is the biggest commercial and business zone in Mexico City. It is located in the West side of this city. Also, three of the most important Universities in the country are located in Santa Fe (Fig. 1). Due to the high rental costs, the majority of the population that works in the area doesn't live there. A big percentage of people move daily to reach and leave the area after work, school or social hours (floating population).

In 2012, it was estimated that floating population in Santa Fe was of 233,000 people each day. Divided into 78,000 with permanent jobs, 40,000 with temporal jobs,

Fig. 1. Location of the area of interest.

100,000 visitors and 15,000 students [3]. Also, students, professors and workers of the three Universities have difficulties to reach their destinations.

Santa Fe is isolated from downtown and public transportation that cover the area is slow, insecure, inefficient and have few options. Also, it isn't connected with the main mass transport lines of the city such as the subway, bicycle network and metrobus (a bus network that has a special lane, similar to a Tranway but with buses).

When Santa Fe was planned, the automobile was the priority. Therefore, the streets and roads are not made for pedestrians or bicycles. This situation leaves few and complicated options for people who have to reach and leave the area.

From the central area of Mexico City to Santa Fe, there are only three main roads. They are constantly saturated because of the number of cars and public transports.

We found out that the community conformed by the three of Santa Fe universities (Universidad Autónoma Metropolitana, Universidad Iberoamericana and Tecnológico de Monterrey) are really affected by these mobility problems. But we also know there is a big potential in solutions made by this community itself.

3 Background

Mobility and transportation are global issues. There are plans around the world that seek to reduce the mobility problems in all sectors of the population. For example, the University of Valladolid in Spain integrated into its institutional development plan a strategy of urban integration and mobility. The idea is to have an "integrated campus" because their buildings are all around the city.

With this plan, they managed to connect the different areas through pedestrian routes, bicycle lanes and open spaces for the community. They connected roads and areas, opened public spaces and made one big University zone [4].

Cambridge is also an example where they tried to give a solution to this problem, but the approach was different. They were looking "to create places where people want to live and work". Their vision is that Cambridgeshire will be a place with strong, growing, prosperous and inclusive communities supported by excellent public services. There, people can fulfill their potential and live healthier lifestyles [5].

On the other hand, Mexico City, also have initiatives in which civil associations have worked together with the government. For example, with the Ecobici program [6]. It is a transportation system for shared bicycles. Registered users can use the bicycles and return them in any bike station. Although it is an initiative that helps many people, the system is only in some areas of the city.

Cities like Amsterdam and Copenhagen have shown public bicycles as a sustainable solution to mobility problems with programs like "smart bike" and "City Bike" [7].

Also, there are companies that promote carpool such as Bla Bla Car [8], worldwide, and Aventones [9], in Mexico, they help to reduce costs and the number of cars on the streets.

We also found projects that are based on digital platforms to analyze and/or solve this problem. For example, the "Twitter Jam" a University of Porto´s project. They know which areas have more traffic based on the Twitts analysis [10].

Another interesting project is the one of the University of Óbuda in Budapest. They gather information from people attending events in Facebook. Also, download information such as weather and the current state of transit. This way, they have enough information to know the movement of the city and to be able to predict congestions or even to prevent accidents [11].

4 Collaboration as an Important Element

To give a better definition of what we understand by collaboration, we return to the proposal by Crook who defines it as: "A coordinated and synchronized activity, the result of a sustained attempt to build and maintain a shared conception of a problem" [12].

From this concept we build the core of the digital tool, that is, to coordinate and synchronize collective actions that generate a shared vision of this problem and create a common channel between the users, so they can work on the solution.

We have the hypothesis that through collaboration and collective action, civil society can solve structural problems. That is why the design of the plan we propose is based in collaboration at different levels (between members of the same or different Universities). The strategy has an elaboration, communication and dissemination strategy seen from the communicative perspective and collaborative design.

"People in their daily lives, intent on their daily struggle with problems, opportunities, and ultimately the meaning of life. We observe how, more and more often, these people (re)discover the power of collaboration to increase their capabilities, and how this (re)discovery gives rise to new forms of organization (collaborative organization) and new artifacts on which they base enabling solutions" [13].

On the other hand, we took a more socially-oriented point of view and built the communication strategy based on Paramio's theory of collective action [14].

Based on this theory, we know that to motivate the use of the platform and collaboration, will be offering some kind of rewards.

5 Methodology

For the development of this project, we will rely on the methodology proposed in the "Developing and Implementing a Sustainable Mobility Plan" manual made by the European Union in 2013 [5]. This manual is divided in 4 phases: Research (or preparation), definition of objectives, elaborating the plan and implementation. Each stage includes a series of flexible and adaptable steps.

To complement the phases, we include tools to collect information in qualitative and quantitative forms. We took this tools from the Communication for Development model developed by the Swiss Agency for Development and Cooperation (SDC) [15]. SDC promotes development and actions for social change through community participation. Also, this document has practically the same phases previously indicated in the European Union manual.

In order to learn more about how the problem affected the University Community, we began our research with the community of the Universidad Autónoma

Metropolitana, Cuajimalpa. This way we understood how the mobility situation affected the community. The approach was made from a quantitative and a qualitative perspective.

For the research phase, we use different tools such as surveys for students, professors and workers; interviews, statistical data analysis, media monitoring, and 5 focus groups. That way we defined the first steps we needed to follow for the construction of the solution.

According to the surveys we made in the University, 17% of the students travel from 0 to 29 min each way, 25% from 30 to 59 min, 16% from 60 to 89 min, 14% from 90 to 119 min, 16% from 120 to 149 min and 12% 150 min or more (Fig. 2).

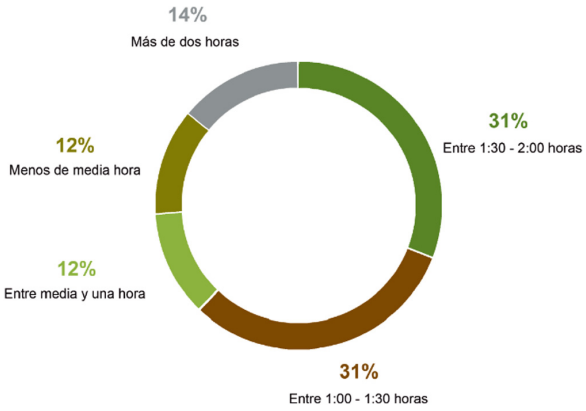

Fig. 2. Some discovering issue of the quantitative research.

In the qualitative e approach, we made focus groups with some students. This helped us to complete the quantitative information previously collected. First we carried out an activity with a physical map where the students could mark their daily route with threads and pins. The color of the threads represented the average ratings they had so far. This dynamic served both for us and for the students to achieve visualize the routes and have more clear the distance they must travel every day. Our discovering's are shown in Fig. 3.

This first stage helps us reach two important conclusions for the plan's construction.

The first one is that the mobility problem has a lot of different factors. This means that it's impossible to think that there is just one solution. We learned that the problem should be approached in different ways, that's why our plan is divided in phases.

In second place, we can conclude that in order to accomplish our objectives and the mobility plan, the solution has to come from the collaboration and collective actions of the community and not depending on the government.

We recognize that it is not viable from our field of study to make structural changes in roads and the transportation system which are controlled by the government and concessionaires.

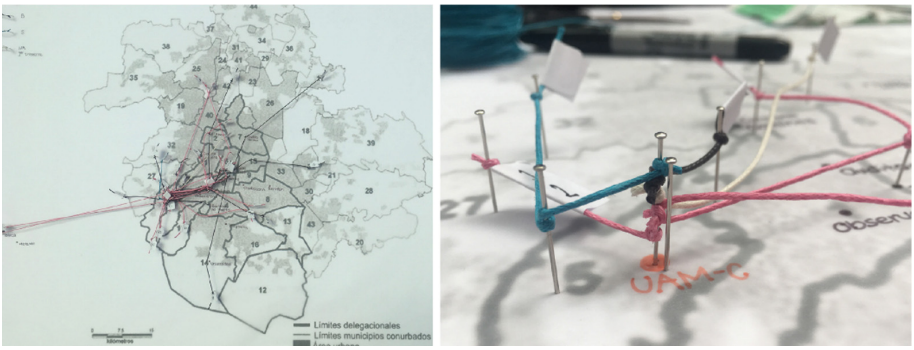

Fig. 3. Some discovering issue of the qualitative research. (Color figure online)

On the other hand, we are aware that, however limited these structural problems may be, the initiative of the civil society, accompanied by our digital tool, and a communication strategy can generate important changes. Therefore, our main objective is to design a collaborative tool between the community of the three main universities of Santa Fe.

6 Collaborative Tool

We decided to divide phase in four different stages: 1. Designing the information system's general architecture based on collaboration. This system will have information on routes, schedules and availability in the transport. 2. The creation of the prototype of the system. 3. Design an institutional collaboration strategy for the launch of the system and for monitoring its use. 4. Plan the communication and dissemination strategy focused on the University Community of the three institutions.

Our surveys showed that almost all members of the University Community have a smartphone and mobile internet plans, so it is feasible that the main communication tool for the community is a mobile app. This way they can share their location and know the status of the transport system. Also, the app will be used while the user is in motion, therefore, it must be intuitive and simple.

In this stage we implement the prototype and start the usability tests. Paper prototype help us to know what information should be included on each screen and to define the system architecture. This process helped us to complement the general functions that were missing and to be clearer how each screen should be. The designs of all the hand-drawn were made and allows us to make a first usability test, where the navigation and the distribution of the buttons were mainly reviewed (Fig. 4).

The information system will be a mobile application where the University Community can view possible routes from point x to the University and the other way around. This way, users can make the most appropriate decision according to their time and preferences cost. If people collaborate to arrive and leave the University together, they will do it faster by sharing a car or a taxi.

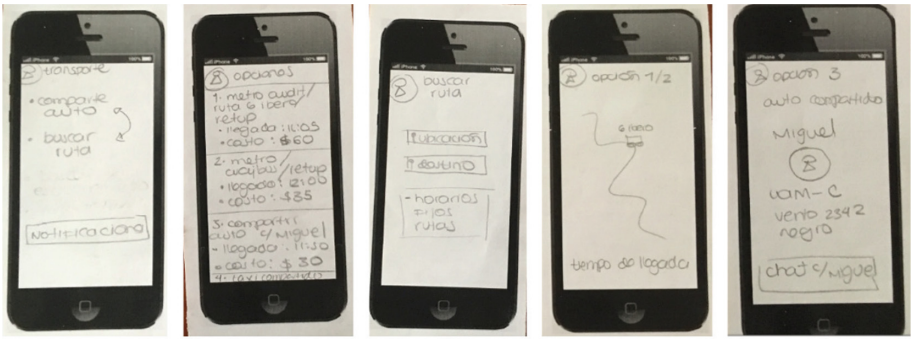

Fig. 4. Paper prototype of the tool.

The app will use an Api from Google Maps [16], and it will be powered by:

- Routes, stations and schedules of subway, *metrobus* and bike line. We decided to use only these transportation systems because they have the most established schedules.
- User profile data: academic institution to which they belong, type of transport used, registration and schedules (schedules may change). Also, users will fill if they own a car.
- Routes taken and kind of transport so that the system can define meeting points either by car or without car.
- Alerts regarding eventualities that arise on the road to Santa Fe such as: collisions, strikes, road congestion and transportation saturation.
- Internal chat so that, once you find a match, the users can agree on the meeting point and time.
- Each University will have a specific server with encrypted information. Therefore, access to the databases will be exclusive to each University and the administrators of each University will not be able to access data from the other institutions.
- The application is responsible for displaying data, not storing information.
- To register in the system will require the user to have a University number to guarantee that they belong to one of the educational institutions.

In order to achieve the project objectives and as part of the final delivery of results, we will develop the prototype of the system. However, we will keep the evidence and results of the work to make improvements.

The next Fig. 5 represents how the system works: first, the information that the system needs from the official public transportation data. Second, recollect the data from the community (University, schedule, routes, Facebook). Finally, the information generated by the interaction between the system and users will create collaborative schedules.

To deal with the economic aspect, we will expect the institutional support of the three universities in economic resources and infrastructure. Also, the plan considers alliances with the private sector and civil associations.

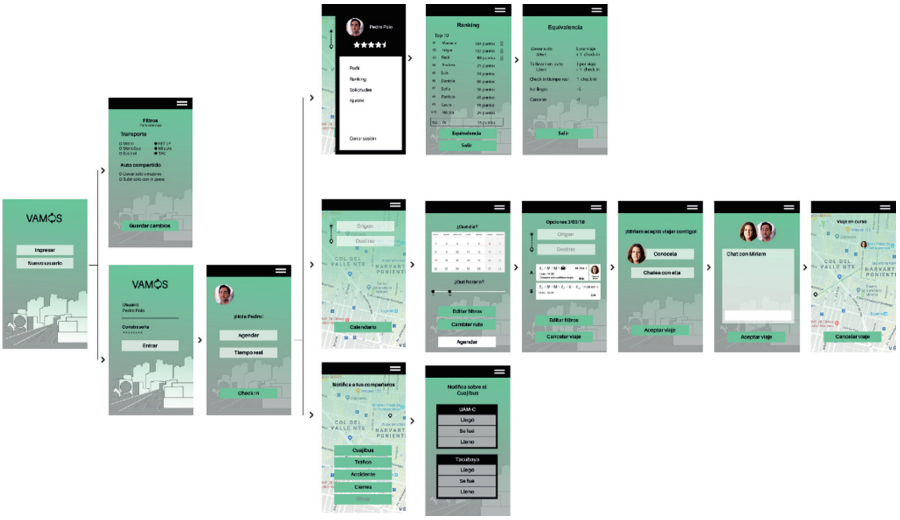

Fig. 5. Collaborative prototype

Database is an important element in the administration of the information. At the moment when users start using the application, a database will be generated and it will give us important information about the different stops and times that have the most affluence. If in any stop the influx is very high, we could talk to the authorities to request a new route of school bus. Also, the community may make requests for new stops and schedules.

These data will give us valuable information about the routes and times of the community that may serve for future projects or updating it. This database shows name, gender, occupation, if the user has a car or not, last stop and time used, score, qualification and if you have requested any additional stop to those that currently exist. Figure 6 shows a schema of the database implemented.

	A	B	C	D	E	F	G	H	I
1	Nombre	Sexo	Ocupación	Auto	Parada	Horario	Puntos	Calificación	Solicitud de parada
2	Juan Pérez	Masculino	Alumno	No	Las Águilas	11:00	40	5	San Ángel
3	Mariana Fernández	Femenino	Alumno	No	Tacubaya	10:30	20	5	
4	Patricio Juárez	Masculino	Profesor	Sí	Balderas	07:00	18	4	
5	Adela García	Femenino	Trabajador	No	Satélite	07:00	7	4	
6	María Teresa Gómez	Femenino	Alumno	No	Las Águilas	13:00	33	5	
7	Fernando López	Masculino	Profesor	No	CC Santa Fe	12:00	-3	2	
8	Gerardo Vazquez	Masculino	Trabajador	Sí	Huxquilucan	07:00	10	5	
9	Daniela Fernández	Femenino	Alumno	Sí	EL Yaqui	09:00	12	4	
10	Erick Hernández	Masculino	Profesor	No	El Yaqui	08:00	24	4	
11	Tania Mendoza	Femenino	Trabajador	No	Satélite	08:30	20	5	Ecatepec
12	Cecilia Laguardia	Femenino	Alumno	No	Balderas	07:00	19	4	
13	Paulina Loera	Femenino	Profesor	No	Balderas	06:00	35	5	
14	Sergio Suárez	Masculino	Alumno	No	Observatorio	13:00	55	4	
15	Mariana Pérez	Femenino	Alumno	Sí	Ibero	10:30	30	4	Metepec
16	Rodrigo Velázquez	Masculino	Alumno	Sí	Las Águilas	11:00	-1	3	
17	Mauricio Vega	Masculino	Profesor	No	El Yaqui	08:00	15	4	
18	Rebeca Juárez	Femenino	Alumno	Sí	Observatorio	09:00	9	5	
19	Sofía Lara	Femenino	Profesor	No	UAM-L	07:30	13	5	
20	Fernanda Martínez	Femenino	Alumno	No	Balderas	07:00	23	5	San Ángel
21	Alejandro Martínez	Masculino	Profesor	No	Observatorio	08:00	12	4	

Fig. 6. Database design

7 Conclusions

It is important to mention that this digital tool is an element that is part of a larger scale mobility master plan for the three Universities located in Santa Fe, which will include an exclusive transportation system with real time location for the University Community, the diversification of internal and external routes and a more extensive inter-university collaborative work.

With this collaboration tool, we seek to lay the foundations for citizens to have new tools that allow them to face the daily problems that seem to have no solution. We believe that if society begins to collaborate, it will be more feasible to generate an important social change based on small actions taken together.

To the extent that the University Community makes use of this collaboration tool, we see a potential for improvement in the economic aspect of the users; in the environmental aspect, since a contribution is made to reduce the emission of Co_2 with the reduction of the traffic and a more rational use of the car, besides improving the efficiency of the routes and the performance of the members in the daily activities.

The plan is designed for a social sector that has demonstrated its willingness to work together. They look through different ways to improve mobility in the Santa Fe area and are aware of the potential to do something by themselves, and not only depend on government actions that have not been effective.

We consider that this project has a solid theoretical, methodological and contextual base. This means that it has an important potential to make a noticeable change in the way the University Community relates with the mobility in Santa Fe.

From the academy, it is necessary to continue with the study of the city and sustainable mobility from different areas of knowledge. Mobility problems have very different causes, and this allows for theoretical and practical approaches that contribute to the solution of them, like this project which was made by the interdisciplinary approach of communication, design and information technologies.

References

1. INRIX Global Traffic Scorecard (2016). http://inrix.com/scorecard/. Accessed 13 Feb 2018
2. TOM TOM TRAFFIC INDEX (2016). https://www.tomtom.com/en_gb/trafficindex/. Accessed 13 Feb 2018
3. Órgano de difusión del Gobierno del Distrito Federal y SEDUVI (2012) Programa parcial de desarrollo urbano de la zona de Santa Fe. http://www.data.seduvi.cdmx.gob.mx/portal/docs/transparencia/articulo15/fraccionxi/PPDU/PPDU_AO/PPDU_ZONA-SANTA-FE_AO-CM.pdf. Accessed 18 Dec 2017
4. De la Rivas, J.: Campus Universitario de Valladolid integración urbana y movilidad. Bitáctora Urbano Territorial **18**(1), 139–156 (2011)
5. Wefering, F., Rupprecht, S., Bührmann, S., Böhler-Baedeker, S.: Devoloping and implementing a sustainable urban mobility plan. European Commission (2013)
6. Ecobici Homepage. https://www.ecobici.cdmx.gob.mx/es/informacion-del-servicio/que-es-ecobici. Accessed 13 Feb 2018
7. De Maio, P.: Smart bikes: public transportation for the 21st century. Metrobike 9–12 (2013)
8. Bla Bla Car Homepage. https://www.blablacar.es/. Accessed 13 Feb 2018

9. Aventones Homepage. https://www.aventones.com/. Accessed 13 Feb 2018
10. Rebelo, F.: Twitter jam: identification of mobility patterns in urban centers based on Twitts. In: IEEE Smart Cities Conference (2015)
11. Mezei, M.: Urban mobility by Facebook events. by: INEES. In: 20th Jubilee IEEE International Conference on Intelligent Engineering Systems (2016)
12. Crook, C.: Computers and the Collaborative Experience of Learning. Routledge, London (1994)
13. Manzini, E.: Design When Everybody Designs. The MIT Press, London (2015)
14. Paramio, L.: Teorías de la decision racional y de la acción colectiva. Sociológica **19**(57), 13–34 (2005)
15. Jenatsch, T., Baue, R.: Comunicación para el desarrollo. Una guía práctica. Suiza. SDC (2014)
16. Google API Homepage. https://developers.google.com/. Accessed 02 Feb 2018