Trazeo: ICT applied to Walking School Buses in Spain

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Abstract—**Nowadays, the development of ICT has had a positive impact in the management of transportation system since they can provide useful information for citizens and local administration in real time. On the other hand, family habits related to children's displacements to school have changed, increasing motorized displacements against active modes. In order to reverse this situation, Walk to School programs are being developed by local administrations. One of the possible actions in these programs is the walking school bus. This article presents a study about the feasibility of a technological tool for the management and coordination of walking school buses: Trazeo. It has been checked that this tool increases the parental confidence on walking routes to school promoting safe, healthy and sustainable habits among children**.

Keywords—walking school bus, ICT, urban transportation planning, active travel, sustainable mobility

I.   Introduction

In the last decades, the presence of the ICT in the daily organization of personal displacements is growing [1]. On the one hand, citizens use them, among other things, to know the waiting time to the next bus [2] or the best route to go in any means of transport to a destination [3,4]. On the other hand, local administrations use large scale dynamic mobility data that ITC provides to optimize the urban infrastructure and transportation plans [5-7].

In addition, the "collaborative economy" is becoming prominence in transportation [8, 9]. In that sense, for example, the number of users of global platforms of carsharing or carpooling is increasing exponentially [10].

These emerging trends are leading to combine advances in computing and engineering with transportation modelling in order to improve safety, mobility and sustainability of transport systems [11-14].

Moreover, in recent decades, family habits related to children's displacements to school have changed, increasing motorized displacements against active modes. This entails a major negative impact on the urban environment, road safety in cities and the physical and psychological development of children.

In order to reverse this situation different actions are being developed in the framework of "Safe routes to school" projects whose aim is to promote a sustainable, healthy and safe mobility among children. One of the more common actions in this kind of projects, specifically aimed at students of the first cycle of primary education, is the Walking School Bus (WSB), which consists of a predefined

adult-scorted pedestrian route to school with several stops along the path where schoolchildren are collected. Although this system was originally created as a voluntary organization of parents who take turns to accompany a group of children, in some schools or cities they have been institutionalized.

In that context, nowadays technology can ease the management of these walking school bus routes and support the implementation and evaluation of Walk to School programs. This article describes Trazeo: a technological tool designed for creating, organizing and monitoring WSB groups. The tool increase parents' confidence on their children's autonomous displacements to school, promote active, healthy, safe and sustainable mobility habits among children.

II.   Description of the Technological Tool

Trazeo is a software tool developed under a General Public License 2 and distributed free of charge, which enables children to make the daily displacement to school in a healthy, safe and sustainable way. To do this, it facilitates the creation, organization and real time tracking of WSB groups.

The tool can be used in WSB in which parents share responsibility for accompanying children or in groups with a fixed monitor responsible to accompany children to school every day.

The system consists of a mobile app for Android and a web version. The main objective of the first one is to use the positioning sensors provided by current smartphones and the real-time data interchange in order to register the children participation, to obtain the positioning data generated by WSB during the displacements, and to provide a communication tool for the WSB members. The web version adds more functionalities and facilitates management tasks like registration, definition of routes, and so on.

In that way, the main functionalities of Trazeo are:

- WSB management: The tool provides a system for creating WSB groups. They can be generated by the administrator which can also edit or delete a group, invite users, and so on. The other users can link or unlink to a group already created.

- Definition of routes: In each group, it is possible to define a route shared by all the members of the group. For that, as shown in Fig.1, a route is set on the map indicating its starting and final point as well as a series of intermediate points that may be relevant for the route (as specific stops to wait for children joining the WSB).

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Figure 1. Example of a walking school bus route

- Real-time monitoring of the route (Figure 2): With the use of GPS devices available on today's mobile phones, a monitoring system in real time is provided, indicating on a map, at every moment, the exact location of the group along the established route.

- Notification System (Figure 3): The tool has a configurable notification system which can alert the users of a group of any kind of event related to the WSB such when a child join or abandon the journey or when the group reach its end point.

- Real-time communication (Figure 4): For everyday organization of the route, the management of incidents (delays, non-attendance, inclement weather, ...) and the publication of relevant information for the members of the group, a chat which facilitates the direct communication among the members of each group is provided.

- Reward scheme for participation: In order to encourage participation, the tool has an incentive program. Each user gains points when registering in the application, creating a group or walking with one of them. The sum of the points gained is stored
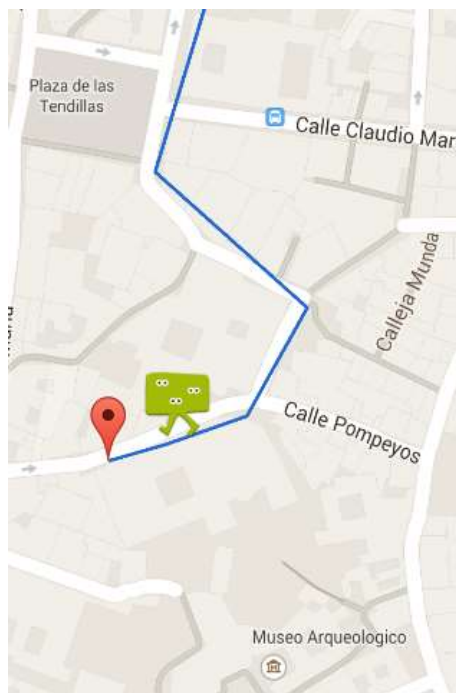
Figure 2. Real-time monitoring of a walking bus group

Figure 3. Notification System

Figure 4.   Real-time communications

in the user's account. This points can be exchanged for prizes and discounts offered by local companies working together with Trazeo.

Finally, a specific Web application working as an administration panel has been developed to manage and analyse the information collected by Trazeo.

Its main functionality is that, from the data of an initial mobility survey filled out by families at the beginning of the project, it is possible to locate on a map each participant by an icon representing the means of transport used usually to go to school (shape of the icon) and the interest of the family on participating in the WSB program (colour of the icon) (Figure 5). In this way, taking into account this information, it is possible to design the WSB routes that best meet the needs of families, helping to promote a change in travel habits of their children to school.

Moreover, this control panel allows the management and statistical analysis of other relevant data related to the WSB groups such as the total distance travelled for each child or for each walking bus group, the time spent on each trip, the number of participants in each travel, and so on.

I.   Study Case: Results and discussion

This article presents a study on the opportunity, feasibility and impact of a new methodology for Walk to School projects implementation based on the integration of a technological support tool that allows the creation, organization and real time monitoring of WSB groups in urban environments.
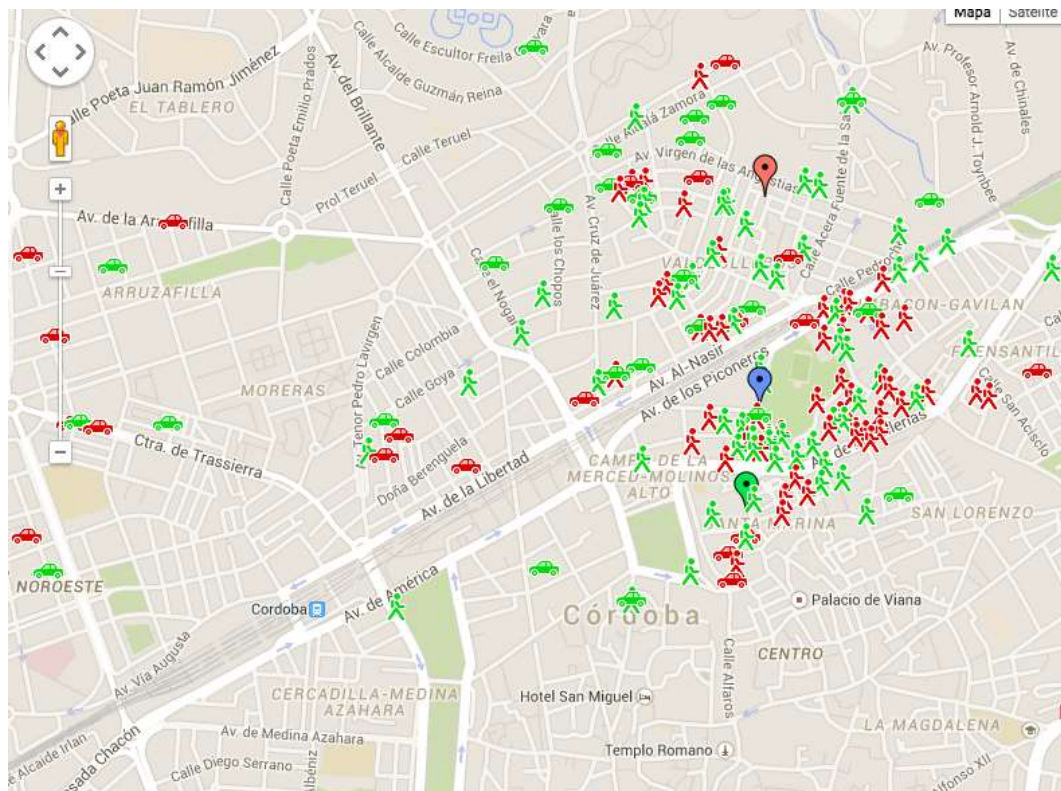

Figure 5.   Map of mobility habits

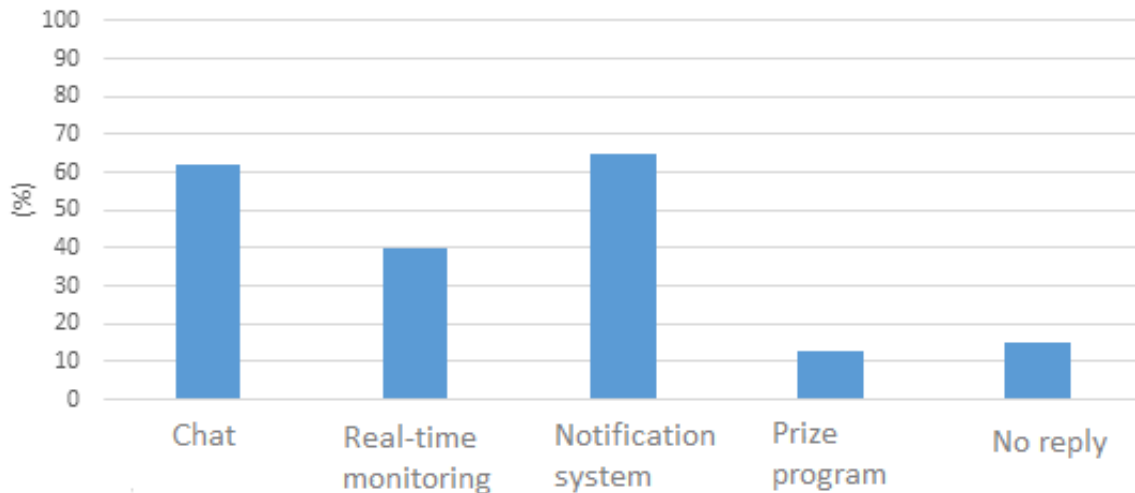## USE OF TRAZEO FUNCIONALITIES

Figure 6.   Functionalities of Trazeo most used by participants

For this, during the last quarter of the academic year, the collaborative tool based on free software, Trazeo, has been introduced to members of three educational communities in the city of Cordoba (Spain), combining WSB groups in which parents accompany the children with other groups in which a monitor scorts children to school every day. 88 schoolchildren from the three schools have participated in a total of 6 different WSB routes.

To assess the impact of the technological tool, at the end of the project, the opinion of the parents whose children have participated in the WSB groups has been collected by means of a survey.

Figure 6 shows the functionalities of Trazeo most commonly used. It is observed that the most used was the notification system, followed by the chat and use the real time monitoring tool, while the lest used was the reward scheme. Moreover, 83% of parents state that Trazeo diminishes their fear to their children' autonomous displacements to school.

TRAZEO SATISFACTION DEGREE

Figure 7.   Participants' satisfaction degree with Trazeo

Finally, the degree of satisfaction of the tool has been very high, as shown in Figure 7, which shows that the score given more frequently to the tool is the highest one (10). This shows that parents consider Trazeo is a valid tool for promoting school walking routes, increasing parental confidence in the independent pedestrian displacements of their children.

II.   Conclusions

This article presents a technological tool for the management and coordination of walking school bus groups: Trazeo. The tool allows the creation, organization and real-time monitoring of WSB groups. It also has a chat to facilitate the communication among members of a group and a system of notification that indicates to each parent when his child has joined the group or abandoned it, and when the group has arrived.

To evaluate its feasibility, it has been applied to the management of some pedestrian routes in three schools in Cordoba (Spain) during the last quarter of the academic year 2014/15. A total of 88 schoolchildren have participated. At the end of the project, to assess the usefulness of the tool, the opinion of the parents of the participants has been collected by means of a survey.

Participants have valued highly the tool and the methodology designed, emphasizing as most useful features of the tool the following functionalities: real-time monitoring, notification and chat. It has also been found that the tool has had a major impact on the degree of confidence of parents regarding the autonomous on foot displacement of their children to school. Thus, it is possible to conclude that Trazeo is a useful tool for managing and promoting WSB in urban environments.
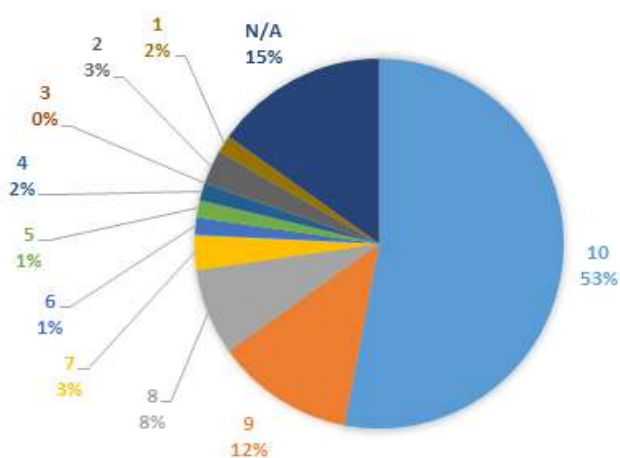
Acknowledgment

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