Current and future challenges for urban mobility

ROBERTO MONTEMANNI, LUCA MARIA GAMBARDELLA
Dalle Molle Institute for Artificial Instelligence
University of Applied Sciences of Southern Switzerland
Via Cantonale 2C, 6928 Manno
SWITZERLAND
{roberto.montemanni, luca.gambardella}@supsi.ch

FRANCESCA CELLINA
Institute for Applied Sustainability to the Built Environment
University of Applied Sciences of Southern Switzerland
Via Trevano, 6952 Canobbio
SWITZERLAND
francesca.cellina@supsi.ch

FABIO CARTOLANO, PAOLA COSSU
FIT Consulting
Via P. Acciaresi 8, 00157 Roma
ITALY
{cartolano; cossu}@fitconsulting.it

ANDREA EMILIO RIZZOLI
Dalle Molle Institute for Artificial Instelligence
University of Applied Sciences of Southern Switzerland
Via Cantonale 2C 6928 Manno
SWITZERLAND
andrea.rizzoli@supsi.ch

Abstract: - SocialCar integrates carpooling with existing transportation modes in urban and peri-urban areas. The system is based on algorithms that plan routes for users and rely on a considerable amount of heterogeneous data. Social networks also play a role. Autonomous vehicles are emerging and will revolutionize transport. We try to understand the impact they could have in a system like SocialCar.

Key-Words: - Urban mobility, carpooling, public transportation, autonomous vehicles, self/driving cars, social media.

1 The SocialCar EU Project

SocialCar is an EU H2020 research project that aims to develop an intelligent transport system based on an innovative approach to transport demand management, and more specifically to carpooling (also known as lift-sharing in the UK and ride-sharing in the US) in urban and peri-urban areas.

The overall objective is to develop a new communication network for intelligent mobility, sharing information on car-pooling integrated with existing transport and mobility systems. The SocialCar network is natively integrated into existing real-time public transport information and carpooling systems, ensuring an effective, high-quality, and enriched multimodal travel planning system for travelers. The platform takes advantage of social media and crowdsourcing practices to communicate, share information, and exchange useful transport data by means of innovative algorithms in order to allow the best just-in-time notifications to travelers.
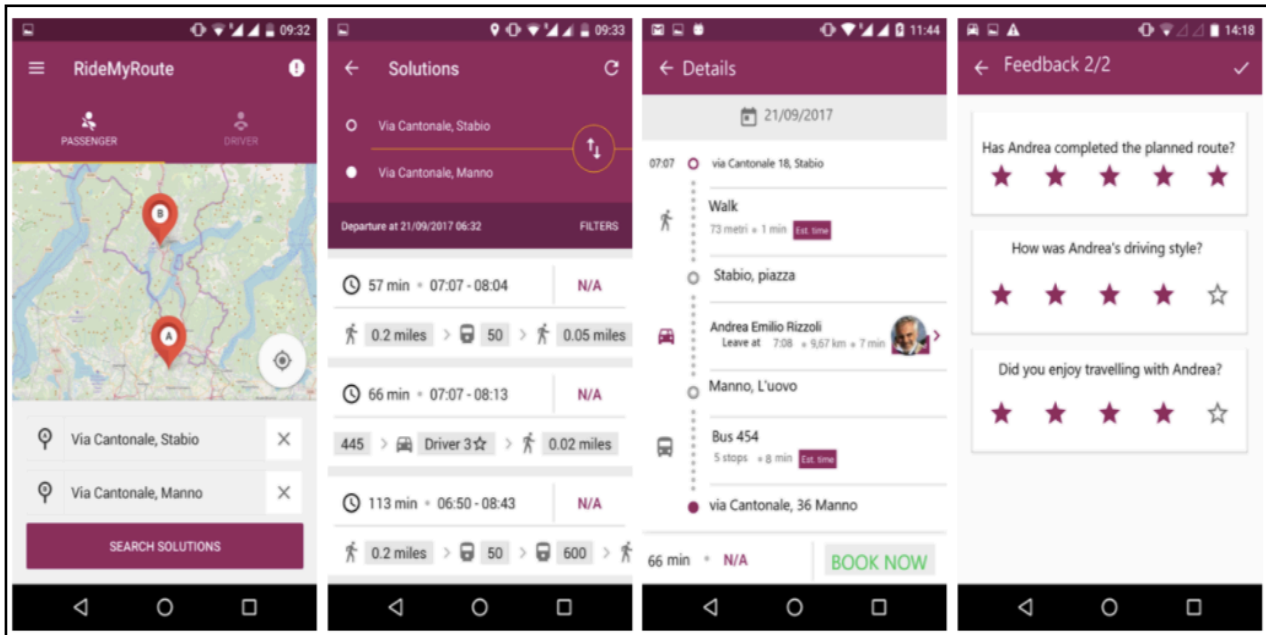
Fig. 1. The SocialCar App. From left to right: the passenger indicates the desired starting and arrival points; the app outputs a list of available mobility options; the passenger selects one option and receives the full sequence of its legs; once the ride has taken place, both the passenger and the driver are requested to leave a feedback on each other.

During its lifetime, the SocialCar project has integrated multiple (public/private/social) data sets by means of powerful planning algorithms as leverage for promoting an effective carpooling service for citizens, making it a complementary transport mode that extends public transport networks. The integration of carpooling with the public transport network has proven that a social and intelligent mobility network deployment is feasible and effective. Big Data related to public transport, carpooling, and crowdsourcing are integrated in a livable environment in order to provide final users with a positive travel experience allowing comparison and choice between multiple options/services. The Route Planner and Ride Matching components of the architecture are described in Jamal et al. (2017). Interaction between users and the SocialCar system is managed through social media and the mobile app, both of which support the living community of users, as depicted in Figure 1. A conceptual architecture of the project is depicted in Figure 2, while an example of the solutions proposed can be found in Figure 3.

SocialCar is not developing or establishing carpooling or on-demand car service software or services, so it is not competing with existing and established products such as UberX [3], Lyft [4], and Carma [5]. Instead, it is developing enhanced features that can be adopted by these and other existing services. These enhanced features will deploy an effective integration of public transport with carpooling and on-demand car services. Recent studies have shown that the attractiveness of carpooling has sometimes been decreasing [6] because of low fuel prices, and strong incomes [7]. The psychological barrier of riding with strangers is also likely to play a role [8]. However, the idea of integrating carpooling with existing transportation modes can potentially invert this negative trend. This is also corroborated by the very recent EU study presented in Finger et al. [9].

The involvement of 10 European urban sites – some of which already offered carpooling services at different maturity levels when the project started, and others of which have developed it during the project – allowed SocialCar to prove the concept's validity and business case, making for easier acceptance of innovative concepts and the consequent application into citizens' everyday life. Testing and validation of the SocialCar system in these sites has been coupled with the development of innovative and transferable business models for the sustainability and scalability of service provision, including their impacts on legal framework. This is the result of the joint effort and expertise of social, transport, and economic professionals within the project team, taking into account environmental, ethical, and security implications.
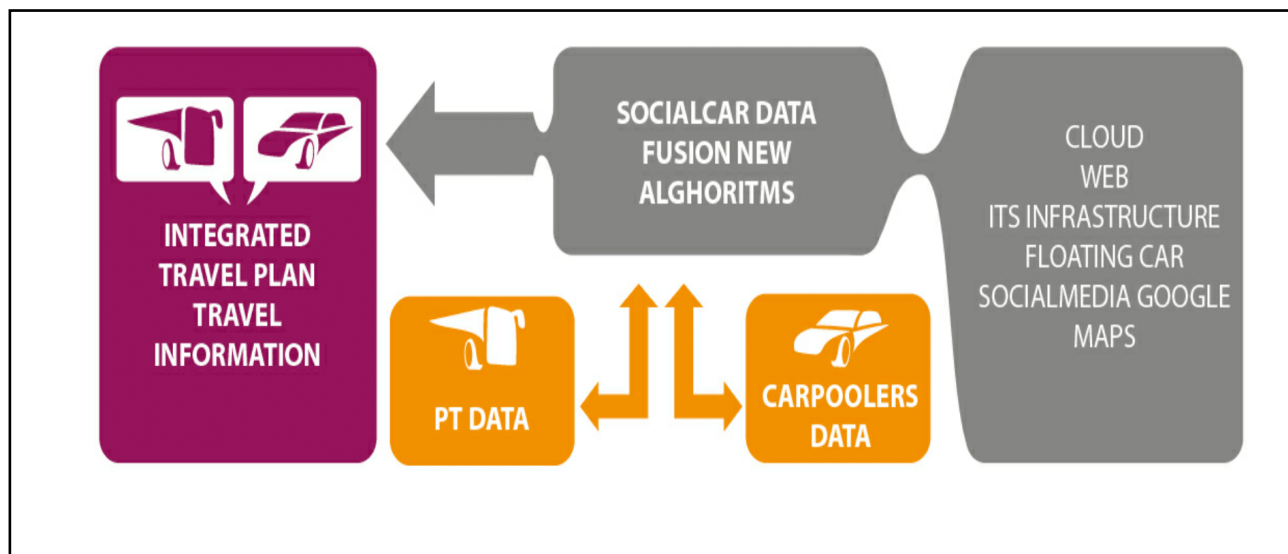
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Fig. 2.   The SocialCar architecture.

2 Autonomous Vehicles and Urban Transportation

The development of autonomous vehicles (sometimes referred to as *self-driving, driverless or robotic* vehicles) has been rapid in the last few years, with remarkable progress motivated by both hardware and software improvements [10]. At the same time, intelligent transport systems are becoming increasingly cooperative and connected (C-ITS) thanks to new technologies (mobile telco, the Internet of Things, Big Data, and artificial intelligence among others and have enabled distributed computational processes in terms of locations and service provisions, all along the value chain.

Hence, the emergence of autonomous cars adds another relevant hint to this evolving framework, increasing the relevance of a deep interaction among infrastructure, vehicles, users; therefore, C-ITS have been declined in more specific terms referring to the digital transformation of infrastructures (smart infrastructure, C-Road) and vehicles (driverless cars, automated vehicles). The C-ITS wording itself has been extended in cooperative, connected, and automated mobility (CCAM), emphasizing the relevance of recent innovative features.

To date, most attention has been concentrated on the capability of autonomous vehicles to drive among human-driven vehicles, and to correctly interact with them on the road. Now the spectrum is enlarging and questions about the impact of such vehicles into general transport planning is becoming an important theme of discussion [11].

At the regulatory level, the European Commission is progressing in identifying suitable scenarios for this future mobility and industrial players (automotive, telco, infrastructure managers, telematics service providers) are strongly engaged in advancing the development of C-ITS and steering the public agenda in favour of services enabling cooperative, connected, and automated mobility, especially focusing on individual transport as key asset in respective markets. Their strategy is to reach and demonstrate effectiveness of new services in terms of traffic fluidity, safety, and comfort, and they aim to be well positioned in the future large take-up of driverless cars. For this reason, they have relevant influence toward the EU in bringing concrete demonstrations, setting standards, and promoting new regulations in favour of individual transports that can feed their markets.

Other institutional organizations (such as UITP [12] and Polis [13]) that are traditionally more inclined to promote the sustainable mobility through reducing land use and car ownership and encouraging collective transport, have shown a certain degree of caution, and even fear, regarding a potential unmanaged uptake of commodities of individual transport and in the future of driverless cars that, by changing the way people will "consume their travel experience", may have dramatic negative effects in multiplying individual transports and at the expenses of public transport [14, 15]. For this reason, they are strongly warning EU and national agendas about activating strategies and long-term policies for an integrated vision of future mobility.

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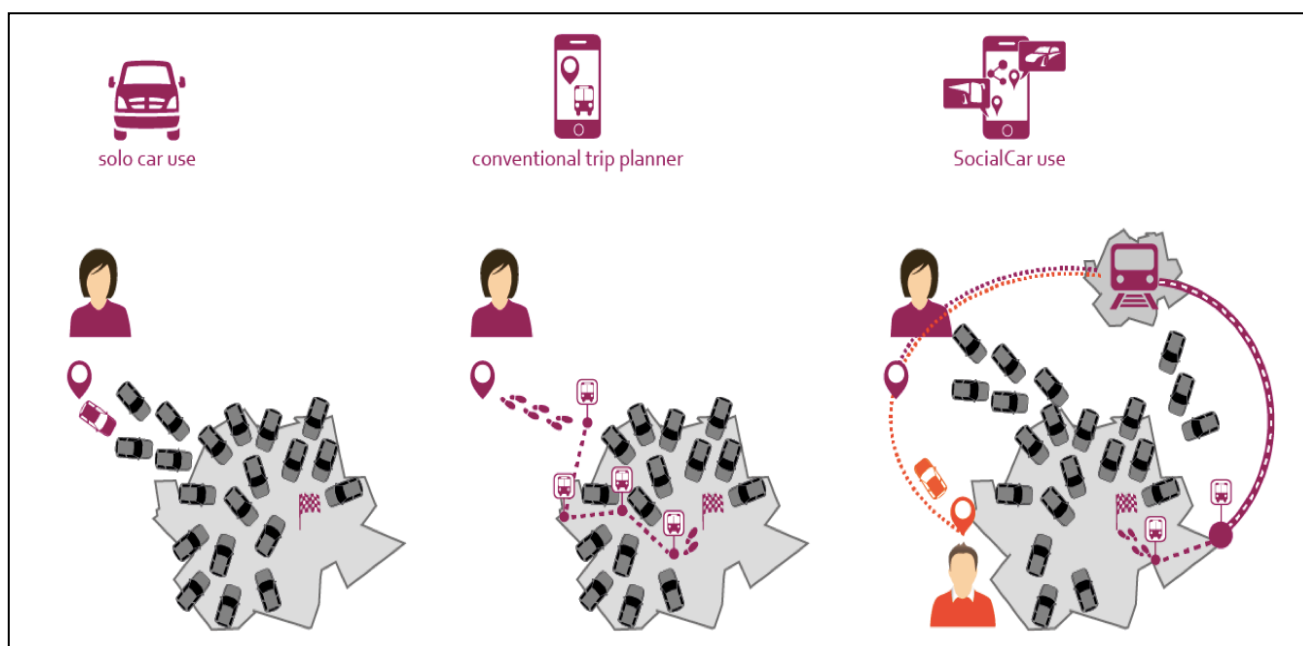Paola Cossu, Andrea Emilio Rizzoli

Fig. 3. Example of the benefits of the use of the SocialCar app.

Therefore, it is evident that there is a creeping conflict between the two categories above presented both trying to influence the position of Member States and therefore the EU agenda.

In addition, some authors have raised concerns about such an impact [16], and support the thesis that autonomous vehicles can be a benefit only if such vehicles are *electric* and *shared* among users.

In the optic of the present article, we are mainly interested in the latter condition: carpooling is an intrinsic form of sharing vehicles. We move further and combine the results of these studies [11, 16] with those of [9], where it is forecasted that carpooling in urban areas is likely to be a reality only if integrated into other modes of transportation, in a Mobility-as-a-Service (MaaS) fashion. From an operational perspective, autonomous vehicles could be integrated in a platform like SocialCar as an *on-demand* transportation service. In the long term – studies refer to a period of approximately 30 years [11] – autonomous vehicles are likely to be the only ones left on the road, and in that case the role of applications like SocialCar, with their crucial carpooling component, will be likely to lose meaning. But before this relatively distant future, we believe that integrating carpooling into existing transportation modes (also including autonomous vehicles in the near future) is likely to be the only way to improve the liveability of our cities, while proving efficient transportation solutions for commuters.

3 Conclusions

The EU Project SocialCar has shown that integrating carpooling services with existing transportation modes can lead to concrete advantages for commuters in urban and peri-urban areas. The integration plays a key role in the success of such a system, together with the development of an appealing and intuitive interface able to also interact with modern social media platforms.

Experts forecast that the advent of autonomous vehicles into our everyday lives will happen relatively soon. They will definitely have an impact into urban transportation, and we believe their integration into a MaaS model could lead to something even more attractive and convenient for the users. Especially in a transition phase lasting for at least a few decades, the role of a system like SocialCar is likely to be extremely central.

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