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Green Information Technology influence on car owners' behavior: Considerations for their operative support in collaborative eLearning and social networks

Mario Matamoros de Luis, Amadeo J. Argüelles Cruz *, Abril V. Uriarte Arcia, Cornelio Yáñez Márquez

Centro de Investigación en Computación, Instituto Politécnico Nacional, México, Av. Juan de Dios Bátiz, Esq. Miguel Othón de Mendizábal, Col. Nueva Industrial Vallejo Delegación Gustavo A. Madero, C.P 07738 México City, Mexico

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ABSTRACT

The study of the influence of the Green Information Technology (GIT), using their potential to reduce the negative impact of the exhaust emission produced by light-duty vehicles, attending verification compliance to circulate in urban areas, is the main topic of the present contribution. Data collected through surveys answered by car owners in Mexico City, place the attention over the knowledge of the official exhaust emission test, their general acceptance, and the understanding of the exhaust test context, once they have received information from the proposed GIT (pGIT). The surveys consider the behavioral intention, attitude toward behavior, perceived usefulness, social influence and volitional control constructs to estimate response of car owners to the concerns about the pollutant emission and their willingness to change their position toward the pollutant emission reduction. The results show the interest of car owners to participate in a collaborative process, and develop positive attitude to cooperate in a social dilemma by considering the use of social networking.

1. Introduction

Transportation is an indispensable activity in the developed and developing countries, because many human needs require of this service to support the complexities of living in the 21st century, shaping modern, service-based economies to reach wealth and prosperity. However, the impact of the demographic and economic changes and the negative implications in the use of fossil fuels, to the environmental deterioration and human health, are considerable (Andersen et al., 2011, 2012; Brunekreef et al., 2009; Riley, 2002; Sigman, Hilderink, Delrue, Axel Braathen, & Leflaive, 2012). In many OECD countries, the effects of anthropogenic activities contributing to the air pollution are demanding special attention; so the design, creation, application and follow of local, regional, and global environmental regulations are essential tasks headed to the reduction of the environment deterioration (Marchal et al., 2012; OECD, 2008a,b,c; Sigman et al., 2012).

In the case of Mexico, and according to the SEMARNAT (Mexican Ministry of Environment and Natural Resources), the National pollutant emission in 2005 report that 61% of air pollution in Mexico comes from mobile sources (SEMARNAT, 2012). One of the initiatives, to solve the problem in cities like Mexico City and neighbor municipalities, is that drivers must get a low emissions level certificate so that their vehicles have the right to travel in the urban area. This certification process has their link to the Mexican normative, which establishes the maximum levels of pollutant emissions from mobile sources. This normative is called NOM-041-SEMARNAT-2012 and was designed in order to standardize the amount of gaseous pollutants from vehicles (Secretaria del Medio Ambiente y Recursos Naturales., 2007). Despite this certification process applied to automobiles, the most recent results from Mexico City's Air Quality Report are not good. Indeed, this suggests that the certification processes and mechanisms to regulate air pollution need improvements (Blackman & Guerrero, 2012; Blackman, Lahiri, Pizer, Rivera-Planter, & Muñoz-Piña, 2010) or alternative solutions like applying carbon and fuel taxes, reforming vehicle taxation and regulating vehicle standards to improve the environmental performance of the transport sector (OECD, 2008c).

Alternatively, the presence and use of the Information and Communication Technologies (ICT) has a profound impact over the way global cities organize their procedures and activities to face the demands of society. ICT offer possibilities for the creation,

* Corresponding author. Tel.: +52 5729 6000x56593.
E-mail addresses: mmatamorosd0700@alumno.ipn.mx (M.M. de Luis), jamadeo@cic.ipn.mx (A.J. Argüelles Cruz), auriarte@sagitario.cic.ipn.mx (A.V. Uriarte Arcia), cyanez@cic.ipn.mx (C.Y. Márquez).

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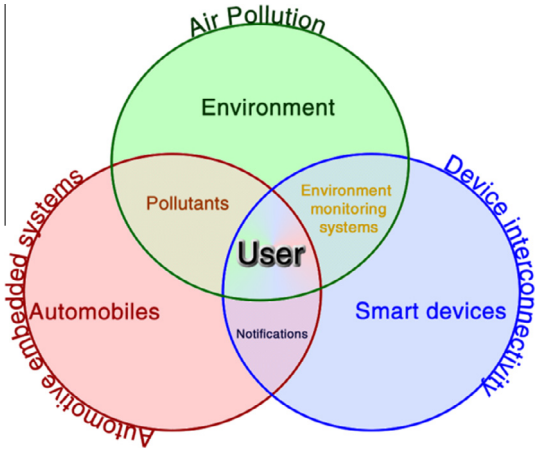

Fig. 1. The user and the vehicle emission control context.

distribution, and management of the information used for the sustainable development and environmental management (Akçura & Avci, 2013; Piro, Cianci, Grieco, Boggia, & Camarda, 2014). However, the consideration to use ICT and regulate vehicle pollutant emissions requires the study of those factors and policies that matter in the decision taken by the individuals and government initiatives to accept ecologically oriented approaches (Boarnet, 2010; Capra, Francalanci, & Slaughter, 2012; Moore, Staley, & Poole, 2010; Nordlund & Garvill, 2003; Winkelman, Bishins, & Kooshian, 2010). Most of the time, individuals require knowing and accepting of economical, psychological, and behavioral implications to use solutions that reduce their vehicular pollutants emissions production and encourage pro-environmental behavior (Steg & Vlek, 2009). The use of Green Information Technology (GIT), for the purpose defined in this paper, has the goal to be part of the intelligent solutions to contribute actively in the reduction of pollution emissions. The participation of the different actors has the user as a central role, like it is shown in Fig. 1, where IT is included in the solution to the environment problems derived for the activities of the transportation sector.

The above can be reach considering the use of knowledge-based information systems, providing the support conditions to deal with the complexity relationships among technology, knowledge and society. By using software technologies solutions, knowledge society have options to face their way of living, working, learning, innovating, and collaborating in today's complex world (Lytras & Ordóñez de Pablos, 2011; Ordóñez de Pablos, 2012).

Beside the input response triggered by humans, by using the collaborative learning and software technologies solutions together, sensors are being providing information about environment weather conditions, both indoor and outdoor, fixed or mobile, wired or wireless, specialized or not, single or distributed as a group, automatically or autonomously activated, among others operation conditions that provides information for the decision taken. Upon that complexity variation of inputs to the solution required to reduce pollutant emission, software technologies solutions require to have an input to the system that let people provide their support conditions and take response accordingly.

This work considers both, the Technology Acceptance Model (TAM) (Davis, Bagozzi, & Warshaw, 1989) and The Theory of Planned Behavior (TPB) (Ajzen, 1991), to determine the reception of the proposed GIT as a tool and the impact in the user's behavior respectively into a specific context: the exhaust emission tests. The main constructors of the proposed model are attitude, behavioral intention, volition, perceived usefulness, social influence, and ease of use.

The following sections cover important points, organized as follows: the second section provides the related works in the field and describes the background theory used in the experiments. The proposed scheme is presented in Section 3 as well as a brief description of the prototype. Sections 4 and 5 provide discussion and conclusions, respectively.

2. Related works

Social networking make use of knowledge-based information systems, providing the support to let people share comments and ideas, to know and react over events around the world by using applications on mobile technologies like smartphones or tablets. When those technologies incorporate the use of sensors, and individuals use them in their activities, such applications are often referred to as crowd-sourcing, participatory sensing or social sensors applications (Sagl, Resch, Hawelka, & Beinat, 2012; Tilak, 2013), and consider the citizen participation or power of the masses (or 'crowds') to achieve their goals, covering aspects like health, disasters, nutrition, among others. They are becoming increasingly common these days, thanks to the rapidly growing affordability, availability and adoption rates of Internet-enabled and location-aware mobile devices (Boulos, Wheeler, Tavares, & Jones, 2011).

Examples of efforts on the line of using IT oriented to the study and application of social networking are worth of mention like GeoChat (http://geochat.instedd.org), Ushahidi (http://www.ushahidi.com). Both of them has their impact to provide support in collecting data from the crowd and visualizes what happened, when and where. Initiatives like Common Scents project in the SENSEable City Laboratory, involving Service Oriented Architectures, proposes an open, standards based and modular infrastructure. The characteristics of interoperability, portability and flexibility ensure the participation of those social sectors, considered in the research, to respond to concrete needs of the inhabitants in Cambridge, MA US (Resch et al., 2011).

Mobile phones are playing an important role in the knowledge society era. Their capabilities to let us communicate, their increase in computational power, and the extension of our perception by the inclusion of sensors and applications, provides users the opportunity to collect, share and remix the information of actual conditions experienced locally instead of only get average measurements by accessing the web (Paulos, Honicky, & Hooker, 2008). This fact provides a fertile land where collaborative learning is increasing their importance, taking support from the interaction of different social activities that improves processes and policies through learning (Lytras & Kurilovas, 2014; Zhuhadar, Yang, & Lytras, 2013). Such platforms, like the Personal Learning Environment, Learning Management Systems, and Service-Oriented Architectures has been used to define systems considering (Lytras & Ordóñez de Pablos, 2011).

There are examples of the use of social networks to promote behavioral changes in the way countries contributes to climate change and global warming: 350 (350.org), Bioneers' Global and Education for Action programs (bioneers.org), Green Living and Social Activism (Care2.com), Transition Us (transitionus.org), Treehugger (treehugger.com). Tom Szaky, founder of Treehugger, provides a note on that sense:

> 'Social media can help to substantial awareness, but the true threat is that people will think retweeting or clicking "Like" will be enough, there is no learning on that. Social media is best used as a "nudge" in the right direction – inspiring behavior, spreading positive ideas and helping to spawn change in the real world. It's bad and ineffective when people find gratification solely by tapping that "Like" icon – because that "Like" in