User Behavior Modeling for Smart Cyber-physical Services through Vehicular Social Networks

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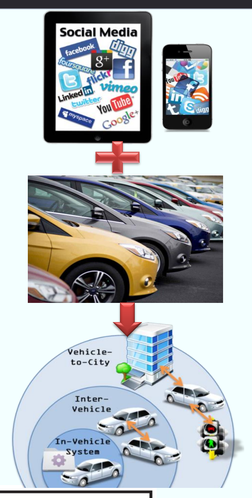
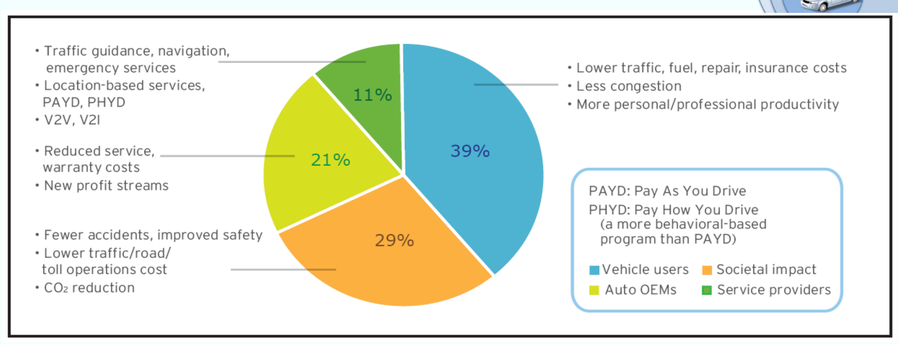
Motivation

- ✓ The rise of social networks (e.g., Facebook) has redesigned how people socially connect
- ✓ Vehicles + Mobile social networks→ Vehicular social networks (VSNs)
- ✓ Smart cyber-physical services in the car
- ✓ Beneficial to private drivers, public transportation, road authorities, and transportation companies





Source: Cisco Internet Business Systems Group, Automotive, Research & Economics Practices, 2011

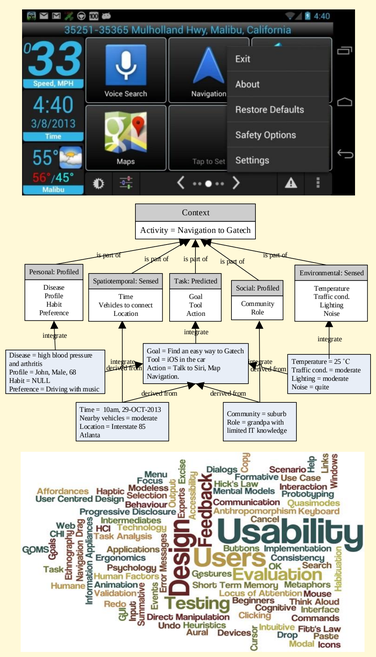
Challenges

- ✓ Personalization → VSNs must be personalized for individuals
- ✓ Smart → The system must be capable of autonomous & proactive operations
- ✓ Usability → Interaction with VSNs must be extremely easy and efficient to ensure safety

iOS in the car

Objectives

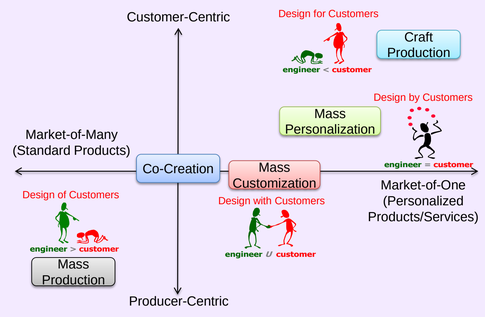
- ✓ Developing an open architecture platform of VSNs for personalization
- ✓ Building a context-aware model for smart services
- ✓ Evaluating and improving usability of VSNs



Proposed Research

Developing an open architecture platform of VSNs for personalization

We propose current mobile operating systems that can install personalized apps for smart services.

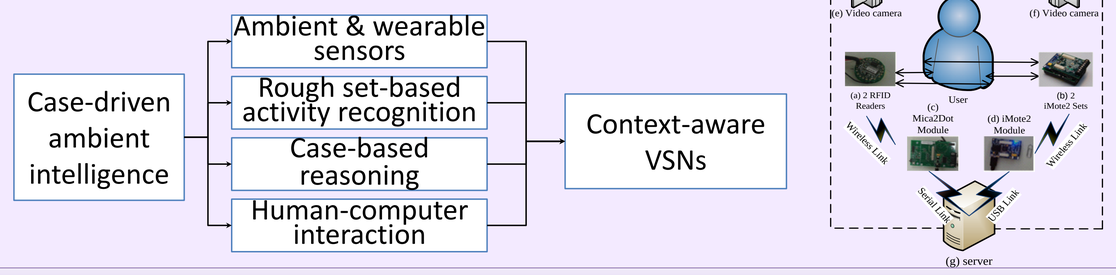


Application platforms	Integration	Open platform	Time to market	Technical capabilities						
	Indicates whether the platform has been deployed (or is planned to be deployed) on *smartphones* or on *in-vehicle* equipment.	A platform increases its value when provides some degree of openness in terms of: • Be based on *standards* • Allowing the development of *third party applications* • *Open source code* and allowing its modification	• **Mature**: available some time ago • **Recent**: available, but growing • **Short term**:available in the next year • **Medium-long term**: not available in the next two years	Accelerometer	GPS	Multitouch screen	Speech technology	Customizable	Cellular communications	Multiple hardware platforms
iPhone OS	Smartphone and in-vehicle	Third party applications	Mature	Yes	Yes	Yes	Yes	Yes	Yes	
Android	Smartphone and in-vehicle	Open source	Recent	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Microsoft Auto	In-vehicle	Closed source	Recent	Yes	Yes	Yes	Yes	Yes	Yes	
MeeGo	Smartphone and in-vehicle	Open source	Short term-Recent	Yes	Yes	Yes	Yes	Yes	Yes	Yes
European ITS Reference Platform	In-vehicle	Standard	Long term	Yes	Yes				Yes	Yes

Source: I. Lequerica, M. G. Longaron, and P. M. Ruiz, Drive and Share: Efficient Provisioning of Social Networks in Vehicular Scenarios, IEEE Communications Magazine • November 2010

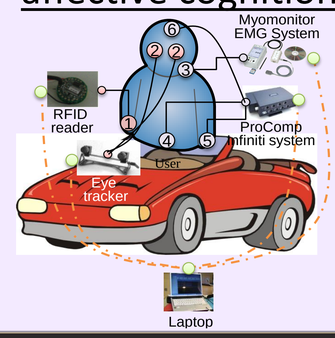
Building a context-aware model for smart services

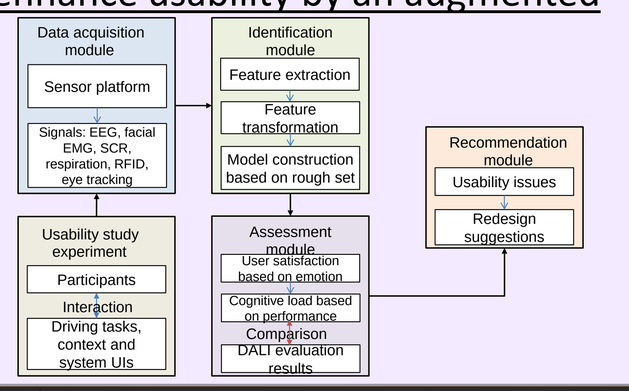
We propose ambience intelligence-based context-aware model that is sensitive and responsive to human needs.



Evaluating and improving usability of VSNs

We propose to evaluate and enhance usability by an augmented affective cognition system.





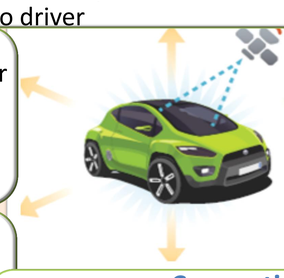
Potential Impact

Our research and development efforts seek to provide smart services via VSNs, computational technologies, and sensor platforms that are explicitly synthesized to model and analyze user-vehicle-cyber interaction behavior in order to design and deliver smart services.

Personalized Experience
- Increasing emphasis on personalization and customization
- Personalized content, media feeds…
- Car adapts to driver

Devices & Integration
- Integration of physical and cyber systems
- Integration of multimode interaction (visual, speech, physiological, behavioral)

Safety & Security
- Protecting passengers, economic driving, reduced traffic accidents/violation
- Rise of safety and security solutions in new vehicles



Pervasive Access
- Seamless on-the-go experience
- Vehicle-to-city, vehicle-to-vehicle, in-vehicle systems interactions

Social & Economic Value
- Greater emphasis on productivity, practicality, & fun
- A new way of social interaction

Connectivity
- Growth in Internet and mobile users
- Enabling traffic optimization for drivers, transportation authorities…
- Upsurge in apps, cloud applications

2014 NSF Young Professionals Workshop on Exploring New Frontiers in Cyber-Physical Systems

National Science Foundation
WHERE DISCOVERIES BEGIN