

## Vision Aware in TollTrans, 2015

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Frontiers are nothing more than boundaries built by men, a figment of the mind. Humankind is unique in the ability to create problems for which he will then spend a disproportionate amount of energy solving. **Interoperability fits in this group.** To be clear, I'm speaking of toll interoperability, where the vehicle identification and the tariff charging have been responsible for the life and death of thousands of pages and arguments, including this one.

For the past decade my company has been investing in several of the streams now discussed and followed in countries where road user charging is being adopted. Our product development lines produced 5.8GHz antennas and on-board units ready for action and conducted European and North-American field-tests with 5.9GHz bringing vehicles and infrastructure together in the therapy chaise-longue, when IoT<sup>1</sup> was just a bunch of letters from the word coote. It comes as no surprise that **I am a firm believer for a radio-frequency solution**, likely being the best way to go. But in the meantime business cannot stop and at some point, each toll operator makes a decision and marches on.

**There was a time where each foreign car was considered an outlaw using our tolled motorways, just for having a different logic of arranging numbers and letters in their license plates. The National Road Authority quickly understood that a solution could only arise from combining the experience and backstage knowledge for dealing with payments, operational processes and technologic prowess. The result was an invitation to apply vision for vehicle identification and automatic association with a credit card. Suddenly, as we recently focus in markets such as Europe and USA - deeply involved in coming up with the Interoperability next best thing - did we realize something surprising for its simplicity. Just by looking inside our home base where things are by some sort of black magic, working. Vision based solutions are already in the field. They serve us with enforcement, video tolling, car inspections and cross-border tolling. They contribute enormously to revenue assurance and even toll leakage control. Having a vision became, all of a sudden, a literal realization of what was to be.**

Vision technology applied to license plate reading has a bad reputation, owed to a shady past where confidence levels failed to impress and couldn't justify the investment. Is it still like this? Take accuracy. We live in a time where just by filming a *bag of chips* MIT is able to reproduce what is being said in the room where it lays (no punt intended). The competitive landscape for digital video cameras is aggressive and prices have gone tumbling down, while quality rose exponentially.

From where we all stand today, the best path to follow is unclear. Roadside and vehicle technology has been in the center of this commotion, where a global solution must define a process up there and beyond it, regardless of the "chosen ones" down below. I would even dare to say, agnostic to. ATI and IBTTA are following this righteous path, separating backoffice and roadside, with the Interoperability Hub and the National Interoperability Committee, where Interface Control is fundamental for the first and standardized technology protocol to the latter. But how to spend energy defining the back process that supports all when there is so much disarray beneath? In the US market alone, expected to double in 10-years' time, we have today seven different technologies on the roadside and vehicle. What if there was already something to focus on, something that would provide business assurance whilst creating the opportunity for stabilizing the above layer of the solution? The knowledge of the overall processes is critical. It allows designing each clog so that when a clear decision is made for which roadside technology prevails, you don't need to change everything. Using vision as a means for business continuity and revenue assurance has already given proof in several applications. It's getting better by the minute, shredding old prejudice. It may even fall short in the end, but by then our collective minds have already figured out if it's 5.8GHz, 5.9, 6C, Satellite or NFC.

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<sup>1</sup> IoT stands for "Internet-of-Things", just in case you've been dodging the "trend-train".

# More than meets the eye: a story on vision

Stories have the ability to take us along a journey. Juan experiences how it all connects, and each solution is heightened not just through its own merit, but also because it is part of a more global and integrated system.

**Vision plays a leading part here.** The knowledge and experience to deal with video analysis, payment processing and revenue assurance were instrumental and a critical factor for adopting those.

## Migration

Having lived his whole life in Spain, Juan decided it was time to move to Portugal. He's taking his own car, still using a Spanish license-plate. Juan knows he's going to use motorways, accepting that the benefit surmounts the toll effort. As he crosses the border and enters Portugal, the National Road Authority advises him to register in Easy-Toll, a nationwide system designed so that all foreign vehicles are able to use free flow tolled motorways in a legal way. **The solution combines automated image processing LPR and Payment Processing**, associating automatically his credit card of choice with the cars license-plate.

## At the motorway

From this point onward, and unlike cars that don't have installed On-Board Units valid in Portugal, Juan is able to use Open Road Tolled roads across the country, still with the original foreign license plate. **License-plate imagery** captured using the LPR solution in Multilane Free flow systems are sent to and analyzed by Tolling Backoffices so that transactions are cleared and processed, crediting the associated cards and channeling to the respective road operators, their owed toll fare for the service. This is a similar concept to the one in Northwest Parkway, Colorado where **image tolling makes use of video accounts** coexisting with the radio-frequency tag accounts, providing simultaneous enforcement for deterring violations.

## Getting legal

Eventually Juan decides it is time to register his car in Portugal. He now has a Portuguese license-plate and needs to go to vehicle inspections regularly. For the national authorities it is important to confirm that the right vehicle is being tested and inspected. For that reason, certified centers use the LPR solution to identify and **associate the recognized license plate imagery to the authenticated process**, without additional discomfort for the car owner or the vehicle inspector, using secured images. In terms of abstraction, it's an isolated system from tolling but vehicle identification stills occurs.

## An honest mistake

Juan becomes seduced by the ETC system in Portugal and decides it is time to install an OBU on his car. After all, Portuguese Via Verde has been pioneering in electronic toll collection and automated services payment: it was time to make the most of it. The main available options for paying tolls in closed-systems in the country are manual, self-service and ETC. When entering, Juan gets to choose one and, at the exit, the tariff is calculated and paid accordingly. But, a certain day, he gets distracted in a conversation while entering on a closed-system motorway, stopping at the manual toll booth and taking an entry ticket, realizing much too late already inside the highway. He then remembers a friend telling him that if this occurs he could still exit the motorway using the ETC lane. In a nutshell, **images are collected in both manual and electronic toll lanes** – at exit and entry points – enabling car identification through the license-plate, being discarded for clean transactions. This way Juan avoids paying a fine and going through the hassle of the administrative process, while the toll concessionaire guarantees toll collection.

## Image Cleared

Capturing the images from each car on the road is sometimes just the beginning. Automated readings may need **manual intervention for a selection of pictures** that don't follow acceptable confidence levels. Manual Image Review platforms are getting better as they are essential to achieve low levels of revenue leakage and discouraging fraudulent behaviors. If his car license plate was dirty the image reading is cleared by a human operator, using high performance and redundant verifications. This is much similar to what ATI Interoperability Hub believes adequate for the US in the coming years, by means of a national license-plate database.

## **No matter where**

The ability to produce solutions does not end in the technology. That is just the basis. One has to know how all connects, where do things make a difference, which are the most valued points from our clients, whether it is comfort, security, revenue assurance or service availability. The **image processing prowess is relevant**, for road user charging, tolling, enforcement, vehicle identification, congestion charging, car inspections, or closed perimeter control: in sum, no matter wherever mobility raises new challenges.