The World Has Been Waiting for this Low Cost, High Performance Solution

Electronic Vehicle Identification (EVI) is the identification of vehicles by means of an electronic tag that authenticates the vehicle. An EVI application includes the integration of a range of technologies including processing, control, communication and RFID. In the most basic EVI applications RFID readers are used to read data from electronic tags and to provide this vehicle related information to enterprise systems.
Electronic Vehicle Registration (EVR) forms part of the vehicle registration and licensing processes, including registration books, roadworthiness, roadtaxes, vehicle insurance, emission-conformance, and the validation of vehicle registration status.

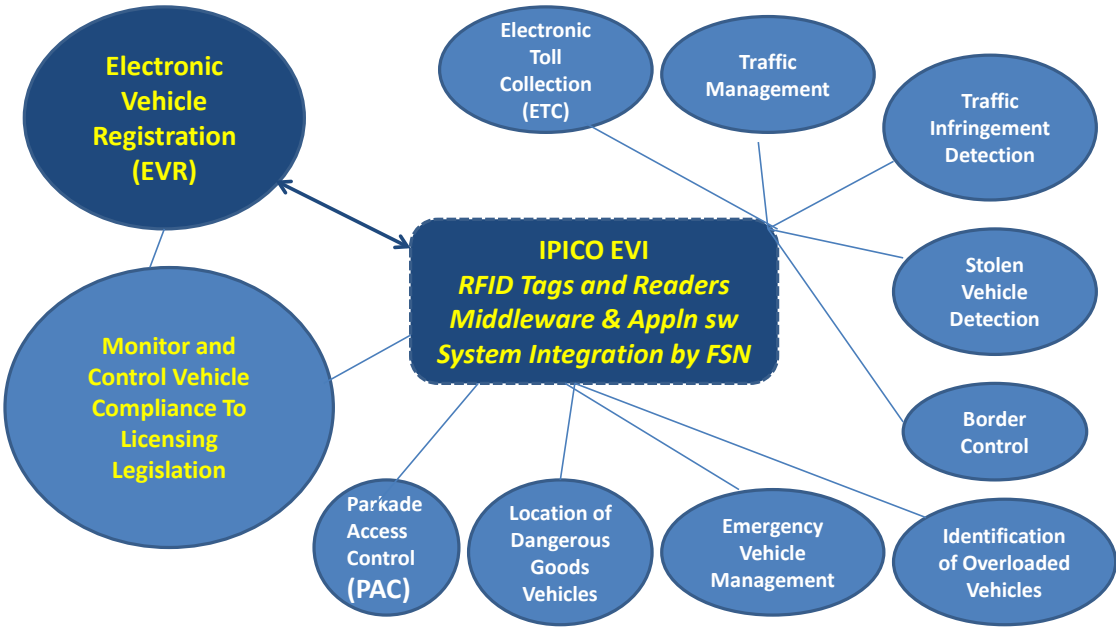
IPICO Passive RFID technology from FALKEN Secure Networks Inc. promises to transform our relationship and administration of the motor vehicle. A few of the many applications in our portfolio include:

- **Automated Toll Highways and Bridges,**
- **License Plate and Renewal Sticker enhancement or replacement**
- **National Vehicle Registration Projects**
- **Emissions Certification,**
- **Secure Parking and Property Access,**
- **Fleet Management**

IPICO EVI Windshield Tag

IPICO EVI Tag – License Plate Sticker type

Electronic Vehicle Identification Integrated System



There have been several roadblocks to effective Electronic Vehicle Identification (EVI) RFID:

- Active RFID solutions are too expensive for global EVI roll out
- Conventional passive RFID just can't reliably handle speeds over of 80 KPH, long read-ranges or wet conditions
- License Renewal Stickers can be counterfeited as well as easily peeled off and affixed on other non-registered vehicles.

IPICO EVI solutions are being rolled out by governments and category leaders around the globe precisely because they reliably operate in real world conditions and within real world budgets. RFID tags and readers intended for EVI applications must meet extremely demanding performance requirements in terms of reading range, speed and dense reader operation.

These performance parameters must be met without compromising security or cost.

The primary EVI performance characteristics include the following:

RFID controlled entrance – Reader circled

- ***Tag chip functionality:*** A factory programmed unique ID, as well as EEPROM (electrically erasable programmable read only memory) that can be programmed and reprogrammed, or locked.
- ***Anti-collision multi-read capability:*** Read multiple and dynamic vehicle populations from overhead or other reader configurations at distances in the order of 7 meters to 10 meters.
- ***Stationary and high speed identification:*** Read stationary vehicles and vehicles at speeds of up to 240 km/h with tag ID and up to 1kbit of tag data being read over a very short time.
- ***Reader density:*** At toll plazas or automatic identification points, large numbers of readers can be active simultaneously, requiring good dense reader performance.
- ***EVI product portfolio:*** Diverse EVI product portfolio to cater for various read scenarios throughout the life cycle of EVI tags, including windshield stickers, license plate tags and driver identification cards, as well as registration, handheld and fixed readers.

EVI security requirements

A distinction must be made between secrecy and security. In EVI applications RFID tags are intended to replace or augment license plates. License plates are never secret and are designed to be as visible secure, i.e. they must be trustworthy. It must not be possible to alter, copy or in any way falsify the information carried by the license plate, or to clone or duplicate the license plate.

IPICO RFID Tags and Readers are:

- **Tuned for windscreen glass**
- **Anti-tamper feature (breaks if removed)**
- **Long read range**
- **Robust anti-collision protocol – more than 30 tags can be read simultaneously**
- **Fast moving tags can be read – up to 250km/h**
- **Passive RFID-No Battery and no battery maintenance program required**

Automated Vehicle Access Control & Monitoring Systems

IPICO's® products, based on radio frequency identification (RFID) technology, are being used to provide everything from automated, controlled access to accurate, electronic collection of parking and toll fees - resulting in significant time and money savings. By combining this leading-edge technology with sophisticated software for billing, reporting, and revenue collection, IPICO is able to provide cost and time efficiency to toll operators, parking garage operators, gated community managers, and corporate and municipal parking facilities.

Traditional manual or mechanical systems require drivers to stop, roll down their windows, swipe a magnetic stripe card, wave a proximity card, type into a keypad, or speak to a guard, to gain access. In contrast, IPICO's non-stop system lets vehicles flow quickly through gates and controlled entrances, or spotting stations at full highway speed.

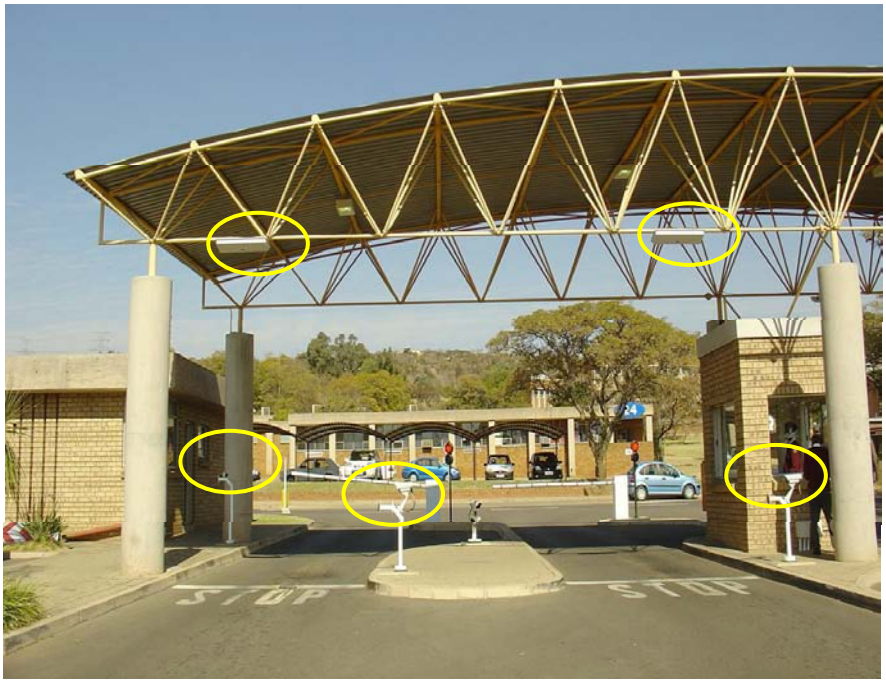
The Benefits

- Non-stop, hands-free operation
- Reduced traffic backup at entrances and exits
- Increased personal security
- Discreet control of security authorization by identification
- Low maintenance and repair costs
- No ticket-issuing machines
- No equipment in the lane that can be damaged by vehicles

IPICO Reader Captures Toll Highway Data

- Tags have a life of many years unless damaged – cannot be lost or wear out
- Automated operation of remote or unmanned gates
- Convenient access for the disabled
- Automatic vehicle inventory monitoring
- Automated fee collection
- Intelligent access control, e.g. only certain vehicles can enter after hours
- Optional Wiegand output from reader

Required components



- **UHF Readers.** The High Performance readers can be used mounted above the roadway (as in the picture above), or above an entrance to a building.
- **UHF tags.** The **ENP label tags** are 170 x 10 mm in size, and are adhesively attached to the windscreen. If attached correctly, they cannot be removed intact. For vehicles without windscreens, the **Industrial Vehicle tag** or **Industrial On-Metal tag** can be used. These are weather-proof, long range, passive tags, and can be mounted onto body-work of the vehicle.
- **Controller and Middleware.** This must be supplied by the System Integrator, and is required to control readers, receive ID numbers from the reader, and operate the access boom or gate and any other hardware devices, e.g. displays or alarms. Depending on the design, the controller may upload the tag data to a network where the tag IDs are checked against a database or the controller may check against its own local database.
- Network connection. Unless the Controller contains a local database, a network connection will be required.

Chip authentication and cloning

Cloning of EVI tags takes place when a valid or registered tag is duplicated and the unauthorized copies of the real tags are illegally installed on vehicles. IPICO's EVI chips each contain a unique 64 bit factory programmed ID. This ID cannot be changed or altered in the field. The chip ID is always transmitted first before any data is transmitted. This ensures that data cannot masquerade as an ID and also makes it very difficult for IP-X tags to be cloned or to introduce rogue tags (i.e. tags from unauthorized sources) into the system.

Factors to consider in designing the system

- **Height of the access entrance** With a power setting of 0.5W ERP, the general limit in Europe, Africa and Asia, 2 to 3 metres read range will be obtained. This is quite adequate for building vehicle access purposes. North America allows greater power with 1W for Handheld and 4W for Stationary Readers.

For toll gate applications and open road traffic monitoring, higher power is required, e.g. 4W EIRP, which will result in a minimum range of 5 metres, depending on the physical constraints of the location, overhead or side-mounted readers can be used.

• **The type of vehicle**. In most cases the 170 x 10 mm ENP tag will be used. However, if the vehicle does not have a windscreen (e.g. a tractor), then the Industrial Vehicle tag can be fitted to any surface of the vehicle, metallic or non-metallic, or the Industrial On-Metal tag can be used, but this should only be used on metal surfaces.

• For **automatic control of a gate or boom**, an application-specific controller is required. This is typically a device (e.g. a PLC) which can receive reader output via RS232, Wiegand, or Ethernet connection, with output switches to control external hardware, e.g. a gate motors. It must also either (1) carry out local verification of tag IDs, which means that it must check each tag ID against its own local list previously downloaded from a computer or network, or (2) be able to operate the gate or boom in response to an instruction from a remote networked computer.

• The **number of read or data aquisition points**. One reader per traffic lane is required. The IPICO I-PX protocol allows all the readers to operate on a single UHF frequency. Each gate or boom will require its own control, and depending on the system architecture, a controller could service several access points.

• **Authorization of access**. This is specific to the particular application, and depends on issues such as whether billing is done (monthly or per entry), or whether a simple verification of tag IDs is sufficient. In every case, the controller must receive an instruction to effect access, or if so designed, it requires a list of authorized tag IDs.

Positioning the Readers

The Reader RF beam size (where tags are readable) depends on the power transmitted, and looks something like this:
The width is about half the length at the half-range point, and varies according to the transmitted power. At 4W EIRP, the beam is about 7 x 3.5 m, whereas at 0.5 W ERP it is about 2.75 m x 1.4 m. The shape and size of the beam varies when other objects, like cars, are nearby. Depending on the size of the read zone, that is, the reader beam, readers can be positioned either above the lanes, or at the side. In all first time implementations, some experimentation may be required.
Overhead readers generally are more easily positioned optimally to cover only one lane. Readers at the side may require more care in setting up, but can be made to work reliably. In one application the side readers were placed at a height of 2.1 m, and angled at 45° to the lane. This proved to be optimum in that case, and would be a good starting point for other applications. The use of humps in the road to encourage cars to allow a longer following distance, or magnetic sensor loops to activate the reader only when a vehicle is in the reader beam, are not normally necessary. If it is necessary, in the unusual case where a vehicle's tag is read both by the reader covering the lane, and by a reader covering another lane, the correct reader can still be determined. The software compares the read rates (the number of tag IDs transmitted per second) from the readers, and selects the reader with the highest rate.

Antenna polarization:
High performance Readers are produced with both with circularly polarized and linearly polarized antennas. We have found that linearly polarized antennas work better (since the tag orientation is horizontal), and a special High Performance reader, HPEVI reader, with linearly polarized antennas is available for Electronic Vehicle Identification applications. In general, HPEVI readers should be mounted horizontally, so that the tag and reader polarizations are aligned. If horizontal mounting of the tags cannot be guaranteed, then circularly polarized readers should be used.

The whole system

In the diagram below is shown a possible configuration for a vehicle access system. In this application a controller is used for to operate the boom mechanism. The tag ID's are sent via the network to a remote network server with our middleware and application software complete with a business rules engine which checks the validity of the tag ID, and if authorized, it sends an instruction to the boom controller. The Server is also connected to a Registration reader which is used for reading and registering tags before mounting and allocation to vehicles. As tags are read and allocated, the database is built up.

Other issues

- **Design of the Controller**

This is specific to the particular application. The diagram above shows one way of implementing a system. There are many other possible configurations, depending on the hardware used, how much computing power is resident in the Controller itself (e.g. whether validation is a Controller function.)

- **Checking suspect tags**

A Mobile reader can be used to read tags to check functionality or authenticity**.**

Vehicle Spotting Application

FALKEN Secure Networks(FSN)—Your partner for RFID automation

If you choose to pursue RFID implementation in your organization, here is the FALKEN Secure Networks commitment to you:

- FSN will provide solution architects to work with you to define system requirements for your particular installation. Multiple locations can be networked together for a central and real-time view and centralized management.
- FSN will do a RFID site survey to validate radio frequencies, tag types, system design and performance
- FSN will provide all necessary hardware and software to make the system work for you
- FSN will integrate the system with your existing enterprise management software
- FSN will provide documentation for the system, including operating procedures
- FSN will train your people
- FSN will provide warranty and continued system support

Contact Us

FALKEN Secure Networks (FSN) is the leading System Integrator and Solution Architect for advanced Active/Passive Unified RFID systems that leverage standards-based technologies. FSN integrates RF technologies for asset visibility, using EPC global standard RFID, Wi-Fi and Real-Time Location Systems (RTLS) for cost-effective design, and turn-key project implementation.

Contact FSN

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