
# The Swatch – EM Marin – Hayek Consortium solution

***Contact***

EM Microelectronic Marin SA
Sors 3
CH-2074 Marin
Tel.: +41 32 755 51 11
Fax: +41 32 755 5? ??
http://www.emmarin.ch

BPU Electronic Systems
Thomas Gyger
BPU Leader
Direct line: +41 32 755 51 00
E-mail: tgyger@emmarin.ch

 Copyright © 2001 by EM Marin SA

# 1 Operating method of the access control system

## *1.1 Introduction*

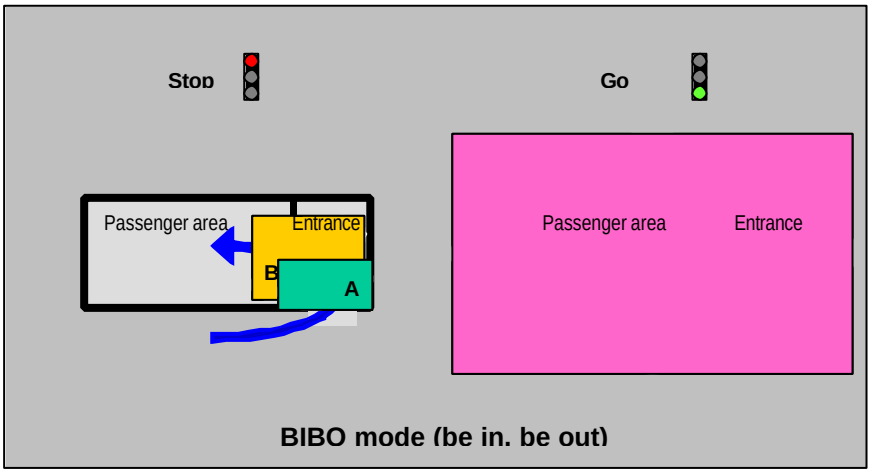
The EasyRide project is essentially intended for all companies within the public transport sector. In order to meet the needs of their clients, such companies already make use of infrastructures and vehicles that are adapted to the type of traffic and passengers within the environment concerned.

The access control system developed by the Swatch – EM Marin – Hayek consortium and installed at the Geneva test site takes into account this diversity of environments. The regional railway line between Geneva and La Plaine and run by the Swiss national railways can be categorised as inter-urban rail traffic in terms of the speed of the trains and distances between the various stops.
Within the city of Geneva itself, on the other hand, on the Geneva Public Transport (TPG) lines, the number of buses in operation at any one time is much greater whilst the distances between the stops can be a question of metres.

In order to guarantee maximum reliability and optimum installation fees for each case, the consortium has developed an access control system whose operating method can be adapted to its usage environment. For this, it benefits from a technology derived from the Keyless Entry Systems available on new generation automobiles.

## *1.2 Presence detection: BIBO mode*

In BIBO mode (Be In, Be Out), the system can detect the presence of all EasyRide card holders between any two stops. These passengers' journeys are then re-created in terms of the stages on the bus line during which their presence was confirmed. The system's BIBO mode is ideal for an inter-urban environment.
When outside the vehicle, the EasyRide card is in standby mode. A passenger entering a stationary vehicle will pass through two zones, A and B, which will activate the card. Once activated, the card communicates with the access control system via radio signals sent at regular intervals during the journey. The presence of the passenger can therefore be monitored throughout the vehicle and for the entire duration of the journey. When the passenger leaves the vehicle, the card returns to standby mode.

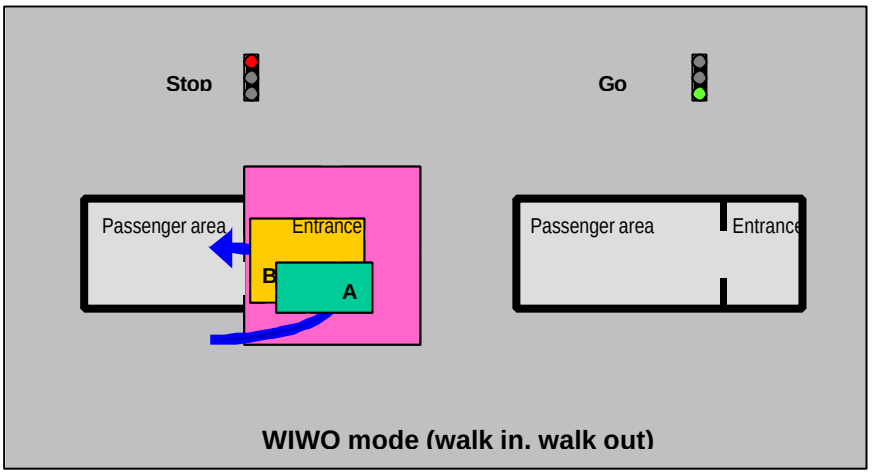


BIBO mode (be in. be out)

 Copyright © 2001 by EM Marin SA

### *1.3 Entrance/Exit detection: WIWO mode*

In WIWO mode (Walk In, Walk Out), the system detects the entrance and exit movements of all EasyRide card holders. These passengers' journeys are then re-created in accordance with the stop at which they entered the vehicle and that at which they exited the vehicle.
When outside the vehicle, the EasyRide card is in standby mode. A passenger entering or exiting a stationary vehicle will pass through two zones, A and B, which will activate the card. The order in which these zones are detected, i.e. A->B or B->A, indicates whether the passenger is entering or exiting the vehicle. Once activated, the card communicates instantly with the access control system via a radio signal sent indicating whether it has been brought into or taken out of the vehicle. When the passenger leaves the vehicle, the card returns to standby mode.




**WIWO mode (walk in. walk out)**

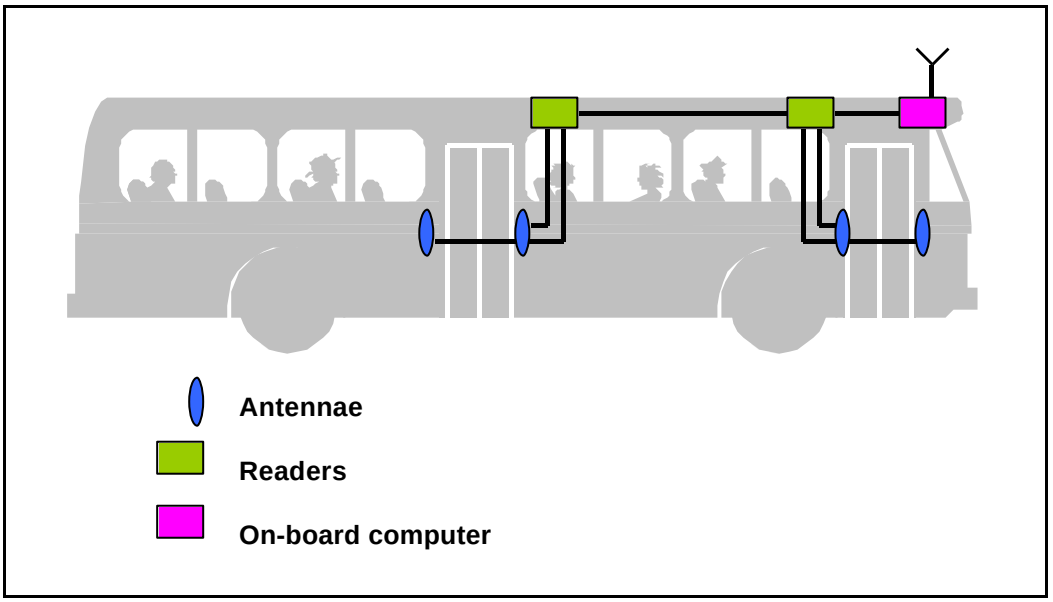
 Copyright © 2001 by EM Marin SA

# 2 System components

## *2.1 Overview*

The access control system developed by the Swatch – EM Marin – Hayek consortium is used to detect the presence of EasyRide cards within a given area and at a given time. The system is installed in public transport vehicles and provides the on-board computer with the necessary information to calculate the journey made by any specific card holder.

The access control system is made up of readers placed in the vehicles next to the entrance doors. Each reader has antennae that are integrated within the vehicle infrastructure and which are used for the communication that takes place between the reader and the card issued to the passenger. The readers thus collect the information contained within each card and transfer this data to the on-board computer via a data transmission network. The data is then transferred to a central system by the on-board computer




## *2.2 The card*

The EasyRide cards are the access key for the overall system. They are fitted with a miniature radio communication module and provide the link between the passenger and the access control system. The only condition for the use of these cards is that passengers must carry them on their person or in their luggage when travelling. They are detected automatically with no need for the holder to take the card out of his or her pocket etc. and pass it through or in front of a specific machine.

The EasyRide card was created using electronic components specially designed for the EasyRide project and guaranteeing minimum energy consumption. The card, which has the potential for further capacity extension, can currently retain up to 200 individual journeys.

 Copyright © 2001 by EM Marin SA

## 2.3 The reader

The reader is an electronic device installed near the entrance doors to the vehicles in question. It is linked up to the on-board computer which transmits to it the geographical position of the vehicle. The reader communicates with all cards within its operating range via the antennae. More specifically, it communicates to the cards the position and identity of the vehicle. In exchange, it reads the identification information on the cards.

The reader also communicates with the on-board computer, to which it sends the data it has received.

The reader is of modest size and can easily be housed within one of the service compartments available on the various types of vehicle.

## 2.4 The antennae

The access control system uses two types of antennae: low-frequency antennae and high-frequency antennae. The former serve two purposes: they activate any cards which pass into their operating range and can detect whether a passenger is entering or exiting the vehicle. Their transmission frequency is 125 kHz and they guarantee the one-way communication from the reader to the card. They can be produced in various shapes and sizes for ease of integration into the type of vehicle concerned. These illustrations show a conical version, which is ideal for mounting onto bars or tubes as well as a flat version for mounting onto walls or partitions.

The second type of antennae is used for bi-directional data communication, i.e. between the card and the reader, above all during journeys. These antennae operate at a frequency of 433 MHz. They are made according to a very slim design and can be easily mounted to ceilings or behind insulation partitions.

 Copyright © 2001 by EM Marin SA

# 3 The consortium

All of the companies within the Swatch, EM Microelectronic Marin and Hayek Engineering consortium were actively involved in the many phases of the EasyRide project.

Our extensive experience in the development of major projects and in the watch-making industry combined with our great capability to innovate enabled us to develop miniature products that were essential for the project as well as multi-applications that were perfectly adapted to the latter's needs. Em Marin, responsible for the technical management of the project on the consortium's behalf, is specialised in the development and production of analogue and digital electronic circuits that operate at a low voltage and very low energy consumption level. This know-how was crucial, above all in the creation of the EasyRide cards.

The identification and access control system presented a major challenge within this project. It is the key element of the infrastructures needed to use the EasyRide system. Thanks to our expertise in developing micro-technologies in a variety of areas, we have found the ideal solution that is perfectly suited to the project concept. Indeed, our consortium is currently a world leader on the market for communication technologies linking an identifier carried by a person and a system (RFID). We have a host of references, from the Swatch Access programmes installed in 450 ski resorts across the globe, within public transport systems and payments systems, to our world leading position for electronic automobile security systems, for example (coded key immobilisers and keyless entry systems).

 Copyright © 2001 by EM Marin SA