Support system for an evacuation of a user from a tunnel.

KEYWORDS

- ROAD AND RAILWAY TUNNELS
- SAFETY DEVICES
- ESCAPE WAY
- INDOOR NAVIGATION
- CERTIFIED MAINTENANCE SYSTEM

AREA

- ELETTRICAL ELECTRONIC & ICT ENGINEERING

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Patent for invention.

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Sapienza Università di Roma 100%.

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Industrial & Commercial Reference
Safety subsystems and devices for emergency exodus in road and railway tunnels.

Time to Market
The basic operating mode has been tested in a road tunnel. For precautionary purposes, a TRL of 3 and a TTM of 1 year are identified.

Availability
Cession, Licensing, Research, Development, Experimentation and Collaboration.

Fig. 1 Road tunnel test site (Framura – SP).

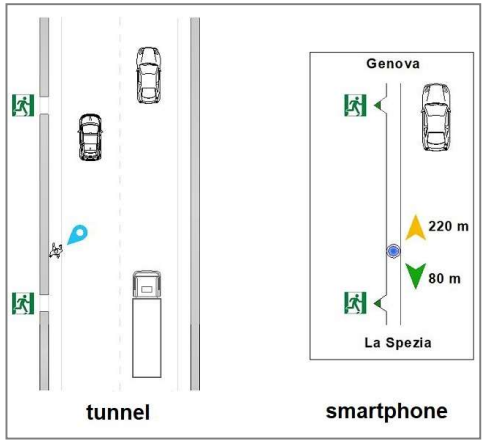
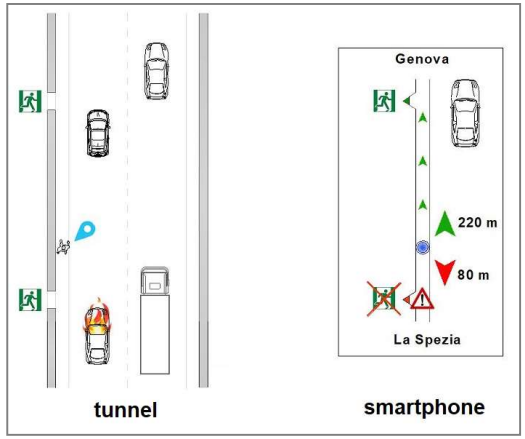


Fig. 2 Displayed information in ordinary conditions.

Fig. 3 Displayed information in emergency conditions.

Abstract
Based on Beacon BLE (Bluetooth Low Energy) devices, the system provides an indoor navigation support service along the walls of a road or railway tunnel, through the use of a common smartphone equipped with a specific application. The system has been developed to work both in ordinary and emergency conditions, in order to provide the user with reliable and dynamic information about the escape route. The system allows also other applications related to increase tunnel safety, including support for rescue teams for salvage operation.



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Support system for an evacuation of a user from a tunnel.

Technical Description

The system is based on Bluetooth Low Energy Beacons (or similar RF devices) installed on the tunnel walls at a height of approx. 3.5 meters and spaced 5-10 meters apart.

Emitted radio signals allow a common smartphone (equipped with a specific application) to provide the user with their position in the tunnel.

Based on a real-time control and programming system, interfaced with the tunnel sensors, it is possible to modify the data transmitted by each individual device in order to provide the user with advanced information, such as, for example, precise and dynamic indication related to the distance from the exits and the escape route to leave the tunnel in case of fire or emergency.

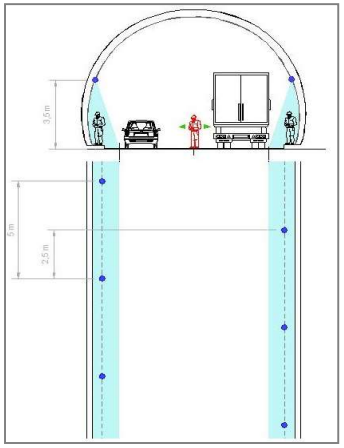

Fig. 4 BLE Beacons positioning in tunnel and radio coverage areas.

Technologies & Advantages

BLE devices and related technical solutions aim to implement a reliable indoor positioning system optimized for the tunnel environment, capable of providing the user with safety information even if the infrastructure is in critical or emergency environmental conditions.

The proposed system has many advantages compared to traditional solutions:

- High density of radio devices that allow to create reliable covering "corridors" on the tunnel walls;
- These corridors formed by small elementary radio areas allow reliable proximity location and timely communication sent to the individual user;
- High functional independence of every single radio device, also in case of failure or accidental event;
- Basic functions guaranteed in case of loss of wiring, based on original back-up power supply system by supercapacitor installed into each radio device;
- High system scalability in terms of functions and applications;
- Low cost and reduced maintenance needs.

Applications

The location system has been developed to operate in road and railway tunnels with the main purpose of providing the user with information on his position, on the distance from the safety exits and on the escape route related also to the actual confined conditions.

Other fields have been identified:

- Support to rescue teams;
- Support to maintenance management, in the field of certified management, when the recording of the localization of the maintenance work is mandatory;
- Autonomous driving support;
- Support to the remote control of robotic devices also in emergency conditions.

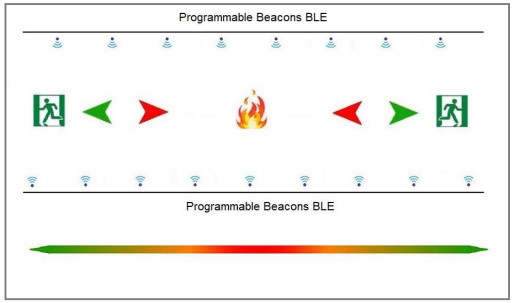

Fig. 5 Dynamic indication of the safe direction.

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