

# UNDERGROUND PERSONNEL MONITORING SYSTEM BASED ON VISIBLE LIGHT COMMUNICATION (VLC) TECHNOLOGY

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## ABSTRACT

**NOVELTY** - The method involves monitoring the position of the LED lamps in real time. The persons wearing the lamps are identified. The LED lamp is provided with the role of information. The data relating to the lamp ID is transmitted to receivers and integrated in the fixed lighting network in the underground space. The data is transmitted by some distributors and stored at the ground surface on a dedicated server. The smart device is connected to an Ethernet switch through a UTP cable and connected to a central Ethernet control panel with integrated support through TCP/IP protocol.

## KEYWORDS

Computer peripheral equipment,  
Communication in visible light,  
Underground monitoring

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## INTRODUCTION

The underground personnel monitoring system aims to identify in real time their position on the main galleries, where the fixed lighting system is already mounted on the gallery ceiling.

The lamp is positioned on the miner's helmet and has the primary function of illuminating, and its secondary role is to transmit the unique code of the lamp identification (lamp ID) through the light. The communication system in the visible light space is embedded in the lamp as an optical emitter.

The unique lamp identification code is transmitted by light to the access points (PA) integrated in the fixed lighting system on the gallery ceiling. PA, with integrated photodiodes and microprocessors, act as an optical receiver.

Each PA adds to the received code, its own identification code containing the position on the gallery, the date and time of receipt of the lamp ID and all this information is sent as an Ethernet frame to the surveillance camera on the surface of the mining company.

The fixed lighting network on the ceiling of the gallery also acts as a network for transmitting information to the surface of the mining unit, up to the surveillance camera. Here, the received data are visualized on a digital map and thus are identified, in real time, all the people underground but also their position on the main galleries.

The lamp ID is an EAN-8 code that is easy to physically write on the lamp, easy to scan and interpret. The same code is written to the lamp module microprocessor. The system is thus simple and efficient.

## RESULTS

### Advantage:

- ✓ Allows the transmission of identification data through the visible space of light without affecting in any way the safety and / or health of personnel in the underground environment or adversely affecting the potentially explosive environment;
  - ✓ Provides real-time information on the underground position of employees and visitors, with the possibility of viewing on a digital map of their position, with a known margin of error in the sizing of the underground lighting system;
  - ✓ Allows the storage in a centralized database of all data related to the position at a given time of persons underground;
  - ✓ The identification codes of the LED lamps are stored in the database, based on the barcodes, together with the date, time and location at which they were identified.;
  - ✓ It allows easy integration into any centralized personnel data management system;
- ✓ Allows easy adaptation to other areas of activity that have as area of activity and other types of underground environment with less hostile environmental conditions than those of the potentially explosive environment for which it is designed:
    - It can be used for any type of underground space illuminated with a fixed lighting system;
    - Can also be used on underground public transport systems (metro);
    - It can also be used for underground mining spaces transformed into museums;
    - It can be used in arranged caves, integrated in the tourist circuit;
  - ✓ Each CSLV Rx PA must periodically send (1-2 hours) its own status signal to signal its correct operation. This feature ensures the identification of possible incidents / accidents / malfunctions that occur underground.

