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Smart community infrastructures — Smart transportation for parking lot allocation in cities

Infrastructures urbaines intelligentes — Transport intelligent pour l'attribution des aires de stationnement dans les villes

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 268, *Sustainable cities and communities*, Subcommittee SC 1, *Smart community infrastructures*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Automobiles satisfy people’s desire to move by themselves at their convenience to anywhere they need or want to go, as explained in ISO 37154. Most cities, especially those that were or are being developed rapidly in a short time, have the same experiences and issues currently or in their history relating to difficulties in finding parking lots or car parks with available spaces.

The limited number of parking lots in a city should be shared by more vehicles more frequently. The low availability of parking lots has unexpectedly caused other city issues besides the difficulty in finding parking lots with available spaces in some cities. It has resulted in irritated drivers, time being wasted and increased fuel consumption. Drivers’ attention is taken up while searching, causing collisions to happen more often. Such incidents and slow driving result in traffic congestion. While driving an automobile at a low speed, more pollutants, particle materials (PMs) and greenhouse gases are emitted into the atmosphere. There is nothing positive about the low availability of parking lots in a city. Citizens, including drivers and people living next to public roads, experience such situations all the time.

ITU-T Y.4456[6] suggests ideal parking lot facilities and outlines technical aspects regarding unoccupied parking spaces, parking space reservation, vehicle automatic access control, self-service parking fee payment and vehicle reverse search, from the viewpoint of enhancement of conventional parking lot services. The concept and goals of smart transportation designated in this document to allocate parking lots to drivers are different from those of ITU-T Y.4456, which mentions parking lot reservation work but lacks the concept and procedure to increase parking lot availability that smart transportation aims at for providing more parking lots to drivers. Finding parking lots that have not yet been offered to the public and allocating to drivers all parking lots already available and recently found will basically increase the availability. ITU-T Y.4456 manages only parking lots currently available to the public. Thus, the issue of parking lot shortage cannot be completely solved. From the viewpoint of city development investments, civil engineering construction is planned, designed, arranged and operated with limited budgets. Digging up and activating unrecognized or unused or unoffered parking lots is still a realistic and easy way to increase the total capacity of parking lots in a city without additional installation. This strategy avoids capital cost preparation for unnecessary parking lot construction.

The availability of parking lots can be increased by another method that effectively allocates and reallocates parking spaces to more drivers more frequently by sharing data as described in ISO 37156 and part of ITU-T Y.4456. With data exchange networks, information on which parking lots have spaces, until what time they are available or unavailable, where they are located and so on is easily collected and immediately shared, resulting in increasing parking lot availability.

Nowadays, protection of people’s privacy is a top priority in any service. This document also describes how such privacy should be protected in the services by applying high security, which is not mentioned in ITU-T Y.4456.

This document describes the concept of smart transportation to efficiently allocate parking lots to drivers in cities and outlines installation and organization of the services. This document also contributes to achieving the United Nations Sustainable Development Goals, in particular goal 3: “Good health and well-being”, goal 7: “Affordable and clean energy”, goal 8: “Decent work and economic growth”, goal 9: “Industry, innovation and infrastructure”, goal 11: “Sustainable cities and communities”, goal 12: “Responsible consumption and production”, goal 13: “Climate action” and goal 15: “Life on land”.

In the development of this document, ISO Guide 82 has been taken into account in addressing sustainability issues.

Smart community infrastructures — Smart transportation for parking lot allocation in cities

1 Scope

This document specifies procedures for installing and organizing smart transportation for parking lot allocation for drivers in cities. It is intended to apply to cities, especially those having a shortage or low availability of parking lots. This smart transportation aims to provide a solution to the city issue of drivers having difficulty in quickly finding parking lots with available spaces. It also aims to address other city issues such as traffic accidents, congestion and energy consumption.

This document clarifies the concept and goals of smart transportation by referring to the technical aspects suggested by ITU-T Y.4456[6].

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
parking lot
cark park
area to park vehicles which are allowed to run on public roads

Note 1 to entry: Vehicles are listed in ISO 37154:2017, 2.5.4, but this document targets automobile-size vehicles privately or personally used (e.g. automobiles, tuk-tuks, manually driven cycle-rickshaws).

Note 2 to entry: 'Parking lot' is preferred to 'car park' in this document as it is more widely used.

3.2
parking lot allocation
suggesting spaces in *parking lots* (3.1) to drivers by finding the best match between drivers' requests or parking preferences and current or expected parking lot availability

Note 1 to entry: Drivers' requests include access routes from current locations, preferred places to park, preferred time to start parking, parking duration, the number of vehicles to be parked and vehicle characteristics, limits of parking fees payable and payment methods.

3.3
parking lot allocation system
arrangement for *parking lot allocation* (3.2) using databases to exchange and share information including parking lot location, parking time recording, navigation to *parking lots* (3.1) and suggestions for parking fee payment procedures and necessary services

4 Concept of smart transportation for parking lot allocation

4.1 General

This subclause describes the general criteria required for smart transportation for parking lot allocation in cities. To solve the city issue of drivers having difficulty in finding parking lots with available spaces, the allocation should be organized and performed to provide more opportunities for drivers to quickly find available spaces and book in parking lots that meet their demands and preferences. This service can be made possible by increasing parking lot availability in a city. Smart transportation has its own goals and aspects different from those of ITU-T Y.4456. Parking lot availability in a city should be increased:

— to provide a greater absolute number of parking lots to citizens and city visitors;

— to offer parking lots to citizens and city visitors more frequently.

To ensure its high performance, smart transportation has:

— high security for driver and parking lot owner identification and privacy, parking fee payment, data transfer and avoidance of rule violations by illegal smart transportation users;

— terminal-to-terminal communication that is decentralized to achieve fast processing and reduce organizational, operational and maintenance costs while maintaining high security.

Since smart transportation results in drivers taking less time to find parking lots with available spaces, it indirectly achieves the following additional benefits by increasing the number of vehicles in a city within the allowable parking lot capacity increased by smart transportation:

— more visitors can be accommodated by a city;

— business can be created and introduced to a city;

— the number of vehicle collisions and traffic accidents can be reduced;

— traffic congestion can be eased;

— discomfort to drivers and people living next to busy roads can be supressed;

NOTE Slow driving could make drivers bored due to the monotonous operation and irritate residents with low frequency noise and vibration.

— synergy between parking pricing and policy measures can reduce the time to search and complete parking.

There is a variety in the kinds of vehicles that are headed for their individual destinations at different locations in a city. The establishment of safe and steady data exchange and sharing platforms is key to successfully organizing parking lot allocation services. Through communication based on the network, information required to immediately allocate parking lots appropriately to drivers is processed and shared among drivers and parking lot owners who have joined a parking lot allocation system. Drivers' requests should best match the conditions of parking lots that currently have spaces or will be available in the time frame requested or preferred by drivers.

To support communication and data sharing, instruments and equipment such as detectors or sensors, telecommunication devices, signboards and displays should also work effectively. Communication and data sharing should satisfy the following conditions:

— communication directly from terminal to terminal;

NOTE A "terminal" is an end instrument or equipment used for communication [e.g. mobile phone, interphone, tablet, PC, point-of-sale (POS) system, onboard unit].

— communication without time lag (e.g. fewer processing steps for users' identification);

— traceable communication;

— offers of large selections for parking lots;

— easy management of the services.

Solar parking lots aim at coupling clean solar electricity and electric mobility deployment. Solar panels provide shade and generate electricity to charge parked electric vehicles. In a vehicle-to-grid approach, the vehicles may also feed the grid and support with ancillary services. Solar parking lots:

— offer environmental and technical benefits;

— decrease injected solar power into a grid and maximize revenues;

— provide incentive schemes that include parking lot stakeholders.

4.2 Applicable city issues and expected advantages

The criteria for smart transportation described in this document are appropriate to address the city issue of difficulty for drivers in finding parking lots with available spaces in a city. As stated in 4.1, the introduction of smart transportation will also bring other advantages besides the solution to this problem. Although smart transportation aims to achieve these advantages, they should not be the top priorities or the main reason for introducing smart transportation because smart transportation does not achieve these directly. Well-organized and well-managed parking infrastructure can also reduce the problem of random parking in unauthorised public places like walkways. Moreover, land is scarce and valuable in cities. Considerately designed and operated parking infrastructure can lead to optimal utilization of parking space.

5 Planning to implement smart transportation for parking lot allocation

To properly implement smart transportation for parking lot allocation and operate it successfully as planned, the following parameters shall be confirmed in advance of implementation:

— traffic patterns in the target city or region;

— traffic volume in the target city or region;

— traffic capacity on public roads in the target city or region;

— number of existing parking lots available;

— location of existing parking lots available;

— area or capacity of existing parking lots available;

— number of parking lots planned;

— location of parking lots planned;

— capacity of parking lots planned;

— mass limits of parking lots allowed;

— dimension limits of parking lots allowed (e.g. clearance);

— payment methods for parking lots available;

— information on novel types of vehicles being used in the city.