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Smart community infrastructures — Smart transportation by facial recognition payment (f-payment)

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Foreword

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This document was prepared by Technical Committee ISO/TC 268, *Sustainable cities and communities*, Subcommittee SC 2, *Sustainable cities and communities - Sustainable mobility and transportation.*

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

Transportation services receive an extremely large number of customers going to a variety of destinations at different times and places in the service networks. Conventional means of payment do not necessarily sufficiently satisfy the customer's individual purpose and preference when using transportation in their respective travel manner. Whenever customers use transportation and its related services, they have to complete payment procedures for the service costs. Formerly, the payment was made in cash in person between the customer and transportation operator. More recently, credit cards have been used. Also, d-payment has been developed and applied as a practical means of payment. This was introduced in ISO 37165. In d-payment, QR-codes are often used for payer identification and payment authorization. However, this application works only when QR-codes are prepared in advance and indicated. In this sense, d-payment applied with QR-codes is not a perfect payment manner. Now, thanks to biometric recognition technology development, the face can be used for identification and authorization in some fields through improved facial image resolution. Such improvement encourages facial recognition applications even in services where high security should be ensured, such as money transfers to/from bank accounts. Introducing digitally processed payments (d-payment) applied with facial recognition payment (f-payment) in transportation and its related services makes travel procedures easy because f-payment does not require the use of hands to make the payment.

Facial recognition is a biometric recognition technology that identifies persons by digitally viewing their faces, processing collected digital images, recognising the person and authorizing their action after identification. A typical application of facial recognition is passport holder identification in immigration inspection in international airports, ports and stations. This application does not allow the substitution of the faces for the facial image in the passport, but it provides immigration officers with another means to identify the traveller. After completing the identification, the traveller's entry into the country is authorized. This helps in effectively ensuring entry inspection security.

In passenger services, customers are requested to pay the fare and fees by purchasing tickets in advance of the transportation or paying cash directly to transportation operators when or after boarding. Cash payment has been replaced with credit card payment. Digital cards by smartphone and QR-codes indicated in paper tickets and smartphones have also become available. However, these means of payment require customers to bring, hold and show such cards and devices to transportation agents upon payment.

Facial recognition, where identification is determined by digitally collecting the customer's facial images as samples and comparing with benchmark images stored as references in a database in advance, has been applied as an identification and authorization tool for payment transactions. On the premise of ensuring privacy, users that allow and agree with the use of their biometric data to authorize payment of transport services, can benefit from a faster dispatch by the transportation operators. F-payment can be a supplement to other payment methods (e.g. cash, credit cards and digital payment). This document describes the concept of f-payment and how to apply it in transportation and its related services.

Smart community infrastructures — Smart transportation by facial recognition payment (f-payment)

1 Scope

This document describes the concept of smart transportation by facial recognition payment (f-payment) and how this means of payment improves the transportation experience for city inhabitants and visitors who agree to use their biometric data.

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 terminology databases for use in standardization at the following addresses:

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

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

3.1
facial recognition
biometric recognition of the face

Note 1 to entry: Biometric recognition is defined in ISO/IEC 2382-37:2022, 3.1.3.

3.2
facial recognition payment
f-payment
payment processed digitally where facial recognition is applied to identify the payer and authorize their action in the payment process

Note 1 to entry: Digitally processed payment is defined in ISO 37165:2020, 3.2.

3.3
smart transportation by facial recognition payment
smart transportation by f-payment
transportation and its related services in which payment is processed by f-payment

4 Concept of smart transportation by f-payment

4.1 Background

Digitally processed payment (d-payment) has been used as a practical payment method since it was developed in the 2010s. This means of payment is characterized by:

— the equivalent d-payment exchangeable for reserve currencies (e.g. US dollars, Euros and Chinese Yuan), that are further exchangeable to local currencies;

— quick payment through decentralization or point-to-point direct transactions;

— free exchange of local currencies with the d-payment equivalent of reserve currencies and vice versa;

— no specific machine-required transaction supported by mobile terminals (e.g. mobile phones and smartphones, tablets, PCs) and through telecommunication or internet services.

F-payment, which is a d-payment option, also has such characteristics, except for the addition of facial image acquisition equipment, which is used to protect the f-payment from facial recognition attacks as designated in 6.3.

However, in a d-payment, at least two things have to be verified for the authorization of the money transfer:

— a digitally readable item such as a credit card, QR code-indicated paper (e.g. ticket, coupon) and display (e.g. smartphone, PC);

— a PIN code.

Thus, whenever using d-payment, customers are requested to show digital materials or devices by holding and then inputting a PIN code by typing. This procedure forces customers to use their hands even while the hands are occupied, regardless of the physical conditions of customers, especially the elderly and people living with a disability. This requirement takes time for a customer to finish d-payment procedures even though a d-payment transaction is completed in less than 200 ms. This is time consuming for the customer before the transaction process starts as well as for the service agents who have to manage many customers lining up for payment.

As described in ISO 37165:2020, 5.1.3, d-payment can improve the quality of the operator's internal management. D-payment can prevent employee fraud because no cash is dealt with and every transaction is traceable by transparent processes that provide information on the time and people making the transactions, the number of transactions made and security algorithm changes. The operator's ID can also be associated with their biometric data (facial image) to improve the auditing quality process of fee payment management.

F-payment enhances customer convenience and operator management quality. In addition to the benefits of the d-payment, f-payment has the following benefits:

— hands-free procedure;

— negligible response time during the payment process.

NOTE The response time of facial recognition is less than 1 s, which is shorter than the payment agreement procedures carried out by customers (e.g. PIN code input, signing) in a d-payment.

4.2 F-payment application in transportation and its related services

F-payment is applicable at least in transportation and its related services as described in ISO 37154:2017, 5.2.6 and 6.3.4. Smart transportation by f-payment can be used in the following cases:

a) Ticket purchase and seat/bed reservations

As mentioned in 4.1, by applying f-payment in ticket offices and vending machines, the time consumed by customers can be saved, which is taken up by showing their credit cards, smartphone displays and other digital devices to the agent and machine and agreeing on the payment to the transportation operator by entering PIN codes or signing. The facial recognition process, using the face which is already ready for image acquisition, takes 1 s for identification and authorization, but the time is negligible compared to the entire f-payment procedure including the money transfer transaction, the procedure of which is the same as for d-payment.

b) Fare/fee direct payment on services

When paying for fare and fees on transportation services, f-payment customers only have to show their faces to transportation agents (e.g. train conductors, bus drivers, ferry crew). This means of payment

saves time taken by customers to prepare cash, hold tickets, pre-paid cards or QR codes and show or touch such items to a reader, a driver or a conductor. Customers can simply show their faces to facial image acquisition equipment even while both hands are occupied. If customers are disabled, especially with the hands, f-payment is helpful and encourages use of transportation.

This means of fare/fee payment is beneficial to both customers and transportation operators, especially for ticketing for train, bus and ferry services where payment should be simple and quickly completed without failure even in unstable vehicle conditions. F-payment does not require transportation agents to receive or hold money until they finish their duty.

c) Item purchase

When purchasing items at shops, customers are busy during the payment process, holding their items and their own personal items. Customers need to start preparing cash, credit cards and smartphones with QR codes after placing the items at the check-out and making the payment. In f-payment, customers are already ready to pay when approaching the check-out.

d) Other facility service reservations

Even beyond payment purposes, f-payment can be applied to reservations for services (e.g. hotel, restaurant) by using facial recognition. The face is used as the ID when checking in at such service facilities.

e) ATM services

Banks have already started authorization services using facial recognition rather than authorization with fingerprints and blood veins. Fingerprints and blood vein authorization requires that fingers and arm skin be perfectly attached on the detector. Such contact procedures are not necessarily recommended from the viewpoint of public health, especially during an epidemic, including COVID-19. The facial recognition procedure in smart transportation, which is contactless, avoids health concerns around contact.

4.3 Target city issues

As explained in 4.1, f-payment complements d-payment services, especially in terms of manual procedures such as typing a PIN code and signing. Smart transportation by f-payment improves upon the issues in d-payment procedures. This makes city life for citizens and visitors convenient and activates the local economy.

4.4 Expected effectiveness

4.4.1 General

Eliminating the manual procedures of d-payment simplifies payment procedures, either digitally or not, by citizens and city visitors who use transportation and its related services.

4.4.2 Customers who will benefit from f-payment

Customers can prefer the use of f-payment in transportation and its related services rather than using cash and credit cards. This is of particular benefit to the following types of customers:

— people with disabilities;

— elderly citizens;

— those travelling accompanied by the elderly, small children or people with disabilities;

— those travelling with luggage;

— customers without a working mobile handset readily available at the time of boarding.

4.4.3 F-payment effectiveness in the service sector

In any service sector, including transportation services, f-payment use is effective, especially in the transportation and related services that are designated in ISO 37157, ISO 37158, ISO 37159, ISO 37162, ISO 37163, ISO 37168 and ISO 37181.

4.4.4 F-payment effectiveness in other situations

F-payment use is effective in the situations listed in ISO 37165:2020, 5.4, which take place in transportation and related services because f-payment is a d-payment option:

— when travelling in and shipping delivery items and freight from international cities;

— when travelling in and shipping delivery items and freight from cities close to a border;

— when travelling in and shipping delivery items and freight from cities with international rail or bus stations, ferry terminals and airports;

— when shopping in passport-controlled areas in international rail or bus stations, ferry terminals and airports;

NOTE In such areas, travellers do not always have local currency to buy items, since they have not yet exchanged their money to local currency after arriving or have used up their local currency before leaving the country.

4.5 Satisfying the UN Sustainable Development Goals

Smart transportation works to satisfy the United Nations' Sustainable Development Goals, especially goal 8 "Decent work and economic growth," goal 9 "Industry, innovation and infrastructure," goal 10 "Reduced inequalities," goal 11 "Sustainable cities and communities," goal 12 "Responsible consumption and production" and goal 15 "Life on land."

5 Facial recognition procedures in smart transportation by f-payment

5.1 General

In smart transportation by f-payment, facial images are collected with cameras and other devices for customer identification and money transfer authorization. In the facial image verification process, collected facial images are compared for personal identification with benchmark facial images as references stored in a database in advance. When collected facial images are verified, the money transfer from the customer's bank account to the payment receiver's accounts is completed, including ticketing or accepting customer rides (e.g. bus). F-payment is supported by:

— terminals (e.g. vending machines, cash registers) which provide customers with f-payment services;

— receipt-accepting payment systems, which are organized for payment receipt management, capital settlement and other services for merchants;

— face routing gateways, which are instituted by credit/debit card clearinghouses as organizations responsible for facial recognition transactions, to receive facial data, payment security codes while synchronized with credit/debit card bank systems;

— transfer clearing systems, which are instituted by credit/debit card clearinghouses to settle money transfer made by f-payment;

— credit/debit card business systems, which are organized by credit/debit card banks to manage a user's bank accounts and funds.

