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Multimedia services

Requirements for video surveillance with mobile premises units

Recommendation ITU-T F.743.11

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Recommendation ITU-T F.743.11

Requirements for video surveillance with mobile premises units

Summary

Recommendation ITU-T F.743.11 defines requirements for video surveillance with mobile premises units. Mobile premises units can effectively enhance the flexibility of surveillance perspectives, expand surveillance scenarios and the application scope of video surveillance technology. Meanwhile, since the current wireless communication technology can support the mobile wireless transmission of video or image data, the application of wireless communication technology to mobile premises units can greatly improve the flexibility of video surveillance and construct a comprehensive video surveillance system. This Recommendation describes the application scenarios and the requirements for video surveillance with mobile premises units.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
1.0	ITU-T F.743.11	2020-08-13	16	11.1002/1000/14324

Keywords

Handheld device, in-vehicle device, mobile premises units, unmanned aerial vehicle, video surveillance.

* To access the Recommendation, type the URL http://handle.itu.int/ in the address field of your web browser, followed by the Recommendation's unique ID. For example, http://handle.itu.int/11.1002/1000/11830-en.

FOREWORD

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The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

Compliance with this Recommendation is voluntary. However, the Recommendation may contain certain mandatory provisions (to ensure, e.g., interoperability or applicability) and compliance with the Recommendation is achieved when all of these mandatory provisions are met. The words "shall" or some other obligatory language such as "must" and the negative equivalents are used to express requirements. The use of such words does not suggest that compliance with the Recommendation is required of any party.

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As of the date of approval of this Recommendation, ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementers are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database at http://www.itu.int/ITU-T/ipr/.

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1 Scope

This Recommendation describes the requirements for video surveillance with mobile premises units. In particular, the scope of this Recommendation includes the application scenarios and requirements for video surveillance with mobile premises units.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

None.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 premises unit [b-ITU-T F.743V2]: A device located at the remote part of a video surveillance system and used to capture multimedia information (such as audio, video, image, alarm signal, etc.) from a surveilled object.

3.1.2 video surveillance system [b-ITU-T H.626V2]: A telecommunication service focusing on video (including audio and image) application technology, which is used to remotely capture multimedia (such as audio, video, image, alarm signals, etc.) and present them to the end user in a user-friendly manner, based on a managed broadband network with ensured quality, security and reliability.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 mobile premises unit (MPU): A mobile device located at the remote part of a video surveillance system and used to capture multimedia information (such as audio, video, image, alarm signal, etc.) from a surveilled object. It has wireless communication capability and can transmit the captured multimedia information through wireless channels. In addition, it can move autonomously or by manual control.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

AR Augmented Reality

CPE Customer Premises Equipment

GPS Global Positioning System

IP Internet Protocol

MEC Mobile Edge Computing

MPU Mobile Premises Unit

PC Personal Computer

PU Premises Unit

UAV Unmanned Aerial Vehicle

VS Video Surveillance

VSS Video Surveillance System

5 Conventions

In this Recommendation:

– The keywords "**is required to**" indicate a requirement which must be strictly followed and from which no deviation is permitted if conformance to this Recommendation is to be claimed.

– The keywords "**is recommended**" indicate a requirement which is recommended but which is not absolutely required. Thus, this requirement need not be present to claim conformance.

6 Scenarios

This clause describes typical service scenario examples illustrating video surveillance with mobile premises units and deriving its service requirements.

6.1 UAV as mobile premises unit

With the development of flight control technology, the applications of UAV have gradually expanded from military fields to civil and industrial fields such as inspection of power infrastructure, border patrol, road testing, water monitoring, port management, accident investigation, fire command and disaster relief. UAVs have many advantages in dealing with specific monitoring tasks, such as rapid deployment and aerial monitoring. The UAVs need to be equipped with a ground station, which is responsible for controlling the UAVs and forwarding video data collected by the UAVs to the video surveillance platform. UAVs with autonomous or controlled flight capability can provide a full range of video shooting perspectives from the air to the ground and transmit the monitoring video to the ground station through the wireless air interface. The ground station can process the video data and transmit it to the video surveillance platform through a wired network or mobile communication networks such as 4G or 5G.

Case 1: UAVs in security industry

When emergencies such as a security incident, traffic accidents or natural disasters occur, the police department can use UAVs to conduct the uninterrupted monitoring of the target accident area from the aerial perspective, and help police officers to fully control the situation.

Case 2: UAVs in petrol chemical industry

At present, the application of UAV based video surveillance in the petroleum and petrochemical industry mainly includes the monitoring of oil pipelines, topographic exploration along pipelines and emergency inspection of pipeline accidents. The remote mobile video sensing solution provided by the UAV enables the people in the monitoring centre to observe directly the situation and status of the site, greatly improving the work efficiency and saving labour costs.

Case 3: UAVs in big data analysis

The UAV equipped with a camera, which is connected to a 5G mobile terminal or CPE of a patrol vehicle, can capture target images and send them to MEC. Relevant big data statistical analysis is performed on the MEC side and then the results are pushed to the screen or command centre. For example, UAVs are deployed in large sports venues to capture real-time vehicle images, and then send them to the MEC terminal through a 5G network to analyse the traffic flow in real time, further driving big data analysis results to large screens or command and alarm centre.

6.2 Wearable device as mobile premises unit

The wearable camera is a portable device that is directly worn on the body or integrated into the clothes or accessories of users, which can be widely used in many fields such as business, entertainment, daily life, national defence, scientific research, industry, agriculture and medical treatment. In video surveillance systems, the wearable sensing device with video capturing, transmission, storage and other computing functions can be used as a mobile premises unit, which can observe the surrounding environment or specific targets with a patrol at any time, anywhere. While the user moves freely, the collected video data is transmitted to the remote monitoring platform through the mobile communication technology to realize interaction with the remote users.

Case 1: Head-mounted network camera

The head-mounted video sensing device is a smart terminal device with data collection and processing capabilities which can be worn. The collected real-time monitoring video can be transmitted to the monitoring platform through mobile communication technologies (such as 4G/5G and/or WLAN). Based on its portability, it is widely used in monitoring and inspection. For example, a head-mounted video surveillance device for the elderly or children can effectively prevent accidental loss. The head-mounted sensing device records the real-time walking route and the action track of the ward and transmits it to the remote monitoring centre through the mobile network. The guardian can check the movement track of the ward at any time and anywhere through the monitoring platform to know whether the current state of the ward is safe or not.

Case 2: Handheld network camera

The handheld video sensing device, a terminal device with data storage, computing and communication capabilities, can collect, process and transmit the monitoring video or image. The handheld devices support different mobile communication technologies (such as 4G/5G and/or WiFi) for convenient and fast interaction with the central video surveillance platform. In addition, handheld video sensing devices can be conveniently carried anywhere, and are mainly used in many industries such as mobile enforcement and the power industry. For example, in police and law enforcement applications, police officers go to the accident scene with the handheld video sensing devices, and use these mobile handheld devices to capture and record the on-site visual information. Meanwhile, the captured visual data can be transmitted to the remote video surveillance centre in real time through the wireless communication module equipped in the handheld sensing device. Furthermore, the handheld video sensing devices usually have a voice communication function which can be used for communication between the on-site police officers and the commander at the surveillance centre.

Case 3: AR glasses with network cameras

AR glasses equipped with a camera are connected to a 5G mobile terminal through WIFI or the CPE of a patrol vehicle, and they send the captured images (such as a human face) to MEC. Relevant big data statistical analysis is performed on the MEC side and then the results are pushed to the AR glasses. For example, the AR glasses wearer can take a picture of a vehicle passing in front, then send the images to the MEC terminal through a 5G network to conduct vehicle recognition, further pushing the target vehicle information to AR glasses in real time.

6.3 In-vehicle information system as mobile premises unit

The in-vehicle video surveillance device can collect and process monitoring video or images in real time according to the internal and external conditions of the vehicle, and transmit them to a monitoring centre through mobile communication networks. The in-vehicle surveillance information system plays a significant role in multiple fields, such as vehicle anti-theft, anti-robbery, driving route monitoring and rapid response of accidents, which aim to solve the problem of dynamic management of existing vehicles.

Case 1: In-vehicle surveillance system for public transportation

The public vehicle on-board surveillance information system can provide favourable assistance for facilitating the driver's work, enhancing the driving safety factor and reducing the occurrence of accidents. It also provides support for strengthening the service specifications of crew members, reducing public security incidents and crimes in public vehicles, public safety forensics, anti-terrorism and so on. Bus on-board video surveillance terminals can obtain the video and images of the bus in real time, and transmit it to the remote monitoring centre platform through the mobile communication network. The management personnel through the remote monitoring of public transportation can provide timely dispatch and command. The wide use of the vehicle video network monitoring system has realized the safety supervision of the whole process of bus operation. It not only saves on management costs for the bus company, it also improves the efficiency and execution of the management.

Case 2: In-vehicle surveillance system for law enforcement

With the advancement of scientific and technological law enforcement, the in-vehicle information system loaded on law enforcement vehicles has played a significant role in the daily enforcement of police officers. For example, smart patrol cars and fire engines, which can instantly capture and record the road conditions and illegal vehicle videos then transmit live videos for accidents in real time to the remote monitoring centre via the mobile communication network, so that the platform supervisor can view the security situation alongside the patrol car at any time. Based on its high mobility and flexibility, significant real-time performance and fast response, the in-vehicle video surveillance system for public security plays an important role in the command and dispatch of law enforcement personnel, traffic management and social security.

6.4 Mobile robot as mobile premises unit

With the comprehensive development of information technology, intelligent mobile robots have been applied to human production and life on a large scale. The mobile robot with autonomous navigation and positioning capability equipped with a sensing device can be deployed in industrial production and human living environments such as hydropower stations, production workshops and airport halls by modelling the scene in advance. The mobile robot monitoring system enables the monitoring of large areas based on a single recording unit. At the same time, the mobile shooting platform can achieve multi-angle and multiposition target monitoring. The mobile robot is used as a carrier for video capture, and the video content can be analysed to obtain corresponding environmental information. The real-time surveillance video or image acquired by the mobile robot in different

environments is transmitted to the monitoring centre through the mobile communication network, so that the monitoring personnel can view it at any time.

Case 1: Robot in industry

Due to the complex terrain or environmental hazard of most industrial scenes, it is not suitable for workers to conduct field surveys and operate on the spot. At this time, the industrial mobile robot will show its great strength. For example, for underground mine monitoring with high risks, the industrial robots equipped with video surveillance systems can easily realize the detection of downhole conditions and video surveillance without the direct use of people, and they send the video to the monitoring centre on the ground through appropriate wireless communication technology. This remote video surveillance scheme enables personnel in the monitoring centre to observe the underground coal-mine conditions directly, thereby greatly improving industrial production efficiency.

Case 2: Robot in service

At present, the visual monitoring technology based on service robots is mainly applied to house cruise monitoring and automatic alarms. The house security inspection robot can freely move and remotely transmit real-time visual data collected from wireless sensor nodes arranged in different locations in the environment by mobile patrol, which is handed over to the data centre for analysis. Users can watch real-time surveillance videos through smart devices such as PCs and mobile phones. If an abnormality is found, the real-time alarm information is sent to facilitate the user knowing of the situation in the first instance. Moreover, the users can query the saved sensor data at the monitoring terminal and control the state of the mobile robot.

6.5 Spacecraft detection system as mobile premises unit

With the development of space exploration technology, more and more space satellites and airships equipped with detection systems perform planetary exploration missions in space; this has meant that the mysterious veil of the universe is gradually being unveiled. The high-definition precision camera mounted on the space probe can capture real visual data of the surface of the star, observe the overall geomorphology, geological processes and geological records (such as mineralogy, texture, structure and stratum) of the detector, and assess the current atmosphere and astronomic environments to analyse the associated processes of surface-atmosphere interaction with each other, which significantly supports the navigation, communication, sampling, extraction and storage of spacecraft detectors and other detection activities. The space exploration system needs to be configured with the corresponding ground station. The image information collected by the spacecraft detector is sent to the ground station through the space communication system to process the telemetry data and transmit it to the command and control centre through the terrestrial communication network.

7 Requirements for video surveillance with mobile premises units

7.1 User requirements

7.1.1 User level requirements

– USR-1: A video surveillance system (VSS) with MPU is recommended to give users different operation rights, which allow the high-level users to have more operation privileges than the low-level ones. The low-level users can do the basic operations which meet the following basic requirements (see clause 7.1.2), and the high-level users can do the advanced operations which meet the following advanced requirements (see clause 7.1.3). For example, the low-level users can only view the movement track of the MPU, while the high-level users can control the MPU as well as view the movement track.

7.1.2 Basic requirements

– USR-2: A VSS with MPU is recommended to support the presentation of the real-time video captured by the MPU for end users.

– USR-3: A VSS with MPU is recommended to support the playback of the historical video recorded in the MPU for end users.

– USR-4: A VSS with MPU is recommended to support end users to check the remaining power of the MPU at any time and determine whether to turn on other power modes.

– USR-5: A VSS with MPU is recommended to support end users to view the historical movement trajectory and real-time positioning information of the MPU.

7.1.3 Advanced requirements

– USR-6: A VSS with MPU is recommended to support end users to control the view angle of the MPU remotely to capture the comprehensive video information.

– USR-7: A VSS with MPU is recommended to support end users to manually control the motion trajectory and moving speed of the MPU.

– USR-8: A VSS with MPU is recommended to support the voice intercom for end users.

– USR-9: A VSS with MPU is recommended to support sending alert messages to end users when an alert event occurs.

7.2 Service requirements

7.2.1 Mobile video capturing service requirements

– SER-1: The MPU is recommended to support the 360-degree rotation of the heading, presenting a comprehensive video surveillance picture.

7.2.2 Video storage service requirements

– SER-2: The MPU is recommended to support the local storage of video streams to save video data directly in the MPU.

– SER-3: The MPU is recommended to support sending the video streams to the remote monitoring centre or the cloud platform for data storage.

– SER-4: The MPU is recommended to support the video data management capabilities, including browsing, querying, playback and deleting of locally stored video files.

– SER-5: The MPU is recommended to support setting configuration information for local video storage, including setting the time period for recording video, setting the time for video retention, etc.

7.2.3 Other value-added service requirements

– SER-6: The MPU is recommended to support recording, cluster intercom, video intercom and group messages.

– SER-7: The MPU is recommended to provide a wide range of expansion interfaces to support peripheral access such as printers, smart display terminals and fire storage boxes.

– SER-8: The MPU is recommended to support the automatic turn on of the dynamic fill light in low-light environments, to assist visual positioning and ensure travel safety, as well as capturing clear video surveillance pictures.

7.3 Security requirements

– SEC-1: A VSS with MPU is required to provide the mechanisms for authentication and authorization. And, it is required to only permit the authorized users to access the system and use the related video applications.

– SEC-2: A VSS with MPU is required to provide the hierarchical authority control and hierarchical password settings to ensure the system security.

– SEC-3: A VSS with MPU is required to ensure the security of accessing and controlling MPUs. Each MPU has access attributes. Only authorized users can access MPUs. The types of access include real-time surveillance, replaying the recorded video, power monitoring, remote controlling, trajectory planning, and so on. An end user can access an MPU according to his/her access privilege of the MPU.

– SEC-4: A VSS with MPU is required to ensure the security of information such as recorded video, digital maps, location information, etc.

– SEC-5: A VSS with MPU is recommended to ensure the security of media stream delivery. It is required to provide security mechanisms, such as video encryption for the media stream and signalling encryption, to ensure the integrity and secrecy of the media data.

– SEC-6: A VSS with MPU is recommended to provide the private protocol protection and ensure the security of encrypted storage of data in local and cloud space.

– SEC-7: A VSS with MPU is recommended to provide the mechanisms for troubleshooting and data backup.

7.4 Management requirements

7.4.1 Terminal management requirements

– MAN-1: A VSS with MPU is required to manage the registration/deregistration, authentication, connection and troubleshooting of MPUs.

– MAN-2: A VSS with MPU is recommended to support MPU management, such as capability parameters and property configuration, status control and monitoring (i.e., MPU activation and deactivation).

7.4.2 Location and mobility management requirements

– MAN-3: A VSS with MPU is recommended to support the position acquisition capability for MPUs.

– MAN-4: A VSS with MPU is recommended to support independent positioning means such as visual odometer to realize autonomous stable movement without a GPS environment.

– MAN-5: A VSS with MPU is recommended to support the offline map caching tool to ensure that map resources can still be obtained under no network conditions.

– MAN-6: A VSS with MPU is recommended to provide real-time positioning information, and encapsulate the positioning information into the video stream simultaneously when recording.

– MAN-7: A VSS with MPU is recommended to provide the remote manual control mechanism of movement trajectory for MPUs (such as UAVs, robots). The operator can control the direction and speed of MPUs in real time.

– MAN-8: A VSS with MPU is recommended to provide the remote automatic control mechanism of movement trajectory for MPUs (such as UAVs, robots). The moving routes of MPUs can be intelligently planned in real time.

– MAN-9: A VSS with MPU is recommended to support intelligent obstacle avoidance and guarantee the route of travel.

7.4.3 Power management requirements

– MAN-10: The MPU powered by battery is recommended to support the multilevel power threshold control and low-power alarm.

– MAN-11: The MPU is recommended to support the multiple energy supply modes, including battery power, solar power and so on. When the battery is low, the alternative charging mode can be turned on.

– MAN-12: The MPU is required to monitor real-time power and support the remote video surveillance centre to query the status of the power.

7.5 Network and control requirements

– NET-1: The MPU is required to support wireless data transmission technologies, such as WLAN, 4G/5G, and digital microwave transmission, and the media data and control signals are required to be transmitted via two separate wireless channels.

– NET-2: The MPU is required to access the IP-based video surveillance (VS) network directly through wireless communication modes or through a gateway.

– NET-3: The MPU is recommended to support dynamic wireless transmission mode adjustment. For example, WLAN transmission mode is changed to 5G network transmission mode.

– NET-4: The MPU is recommended to support adaptive bit rate adjustment according to the current wireless network bandwidth resources.

7.6 Quality of service requirements

– QUA-1: A VSS with MPU is recommended to support the adaptive wireless channel detection technology to ensure the stability of over-the-horizon data transmission.

– QUA-2: A VSS with MPU is recommended to support the automatic selection of the best wireless channel so that it can switch channels and adjust the video bit rate dynamically according to network conditions to ensure the stability of the video stream transmission.

– QUA-3: A VSS with MPU is recommended to support long-distance control and multichannel data transmission to obtain powerful anti-interference ability and ensure the stability of data transmission.

7.7 Reliability requirements

– REL-1: A VSS with MPU is recommended to provide the core sensor redundancy and sensor fault detection, which can automatically switch to redundant sensors if an abnormality occurs.

– REL-2: A VSS with MPU is recommended to provide omnidirectional sensing and intelligent obstacle detection. The MPU is equipped with visual or infrared sensors in different directions for auxiliary positioning and obstacle perception to avoid the movement malfunctions in a narrow and complex environment.

– REL-3: A VSS with MPU is recommended to provide strong environmental adaptability and anti-interference ability.

– REL-4: The MPU is recommended to support the power-off protection function, which guarantees the integrity of important data in case of sudden power failure.

– REL-5: The MPU is recommended to provide stable anti-shake performance with the characteristics of waterproof, dustproof and anti-fall, which is suitable for all-weather field work.

Bibliography

[b-ITU-T F.743V2] Recommendation ITU-T F.743V2 (2019), *Requirements and service description for video surveillance*.

[b-ITU-T H.626V2] Recommendation ITU-T H.626V2 (2019), *Architectural requirements for video surveillance system.*

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