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SERIES Y: GLOBAL INFORMATION INFRASTRUCTURE, INTERNET PROTOCOL ASPECTS, NEXT-GENERATION NETWORKS, INTERNET OF THINGS AND SMART CITIES

Internet of things and smart cities and communities – Services, applications, computation and data processing

Requirements and functional architecture of smart fire smoke detection service

Recommendation ITU-T Y.4558

International Telecommunication Union

ITU-T Y-SERIES RECOMMENDATIONS

GLOBAL INFORMATION INFRASTRUCTURE, INTERNET PROTOCOL ASPECTS, NEXT-GENERATION NETWORKS, INTERNET OF THINGS AND SMART CITIES

GLOBAL INFORMATION INFRASTRUCTURE	
General	Y.100–Y.199
Services, applications and middleware	Y.200–Y.299
Network aspects	Y.300–Y.399
Interfaces and protocols	Y.400–Y.499
Numbering, addressing and naming	Y.500–Y.599
Operation, administration and maintenance	Y.600–Y.699
Security	Y.700–Y.799
Performances	Y.800–Y.899
INTERNET PROTOCOL ASPECTS	
General	Y.1000–Y.1099
Services and applications	Y.1100–Y.1199
Architecture, access, network capabilities and resource management	Y.1200–Y.1299
Transport	Y.1300–Y.1399
Interworking	Y.1400–Y.1499
Quality of service and network performance	Y.1500–Y.1599
Signalling	Y.1600–Y.1699
Operation, administration and maintenance	Y.1700–Y.1799
Charging	Y.1800–Y.1899
IPTV over NGN	Y.1900–Y.1999
NEXT GENERATION NETWORKS	
Frameworks and functional architecture models	Y.2000–Y.2099
Quality of Service and performance	Y.2100–Y.2199
Service aspects: Service capabilities and service architecture	Y.2200–Y.2249
Service aspects: Interoperability of services and networks in NGN	Y.2250–Y.2299
Enhancements to NGN	Y.2300–Y.2399
Network management	Y.2400–Y.2499
Network control architectures and protocols	Y.2500–Y.2599
Packet-based Networks	Y.2600–Y.2699
Security	Y.2700–Y.2799
Generalized mobility	Y.2800–Y.2899
Carrier grade open environment	Y.2900–Y.2999
FUTURE NETWORKS	Y.3000–Y.3499
CLOUD COMPUTING	Y.3500–Y.3599
BIG DATA	Y.3600–Y.3799
QUANTUM KEY DISTRIBUTION NETWORKS	Y.3800–Y.3999
INTERNET OF THINGS AND SMART CITIES AND COMMUNITIES	
General	Y.4000–Y.4049
Definitions and terminologies	Y.4050–Y.4099
Requirements and use cases	Y.4100–Y.4249
Infrastructure, connectivity and networks	Y.4250–Y.4399
Frameworks, architectures and protocols	Y.4400–Y.4549
Services, applications, computation and data processing	**Y.4550–Y.4699**
Management, control and performance	Y.4700–Y.4799
Identification and security	Y.4800–Y.4899
Evaluation and assessment	Y.4900–Y.4999

For further details, please refer to the list of ITU-T Recommendations.

Recommendation ITU-T Y.4558

Requirements and functional architecture of smart fire smoke detection service

Summary

The fire smoke detection service is usually deployed in indoor environments such as residential buildings, factories, shopping malls, hotels, office buildings, etc. With the development of society and economy, the fire smoke detection service is playing a more and more important role in people's life. However, there are some issues such as inefficient maintenance and management, non-real-time device failure detection, non-real-time fire alarm notification and poor service experience.

To address these issues, the smart fire smoke detection (SFSD) service not only detects smoke concentration through sensors, and triggers a fire alarm when it reaches a certain threshold to prevent disaster, but also uses the network to send the alarm information to the cloud platform, thus notifying relevant departments and personnel in time through web/APP/SMS/voice/instant message client, etc. The SFSD service can provide many benefits, including efficient maintenance and management, real-time alarm reports, real-time fault reports and good service experience.

Based on these observations, Recommendation ITU-T Y.4558 describes the requirements and functional architecture of the SFSD service.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
1.0	ITU-T Y.4558	2020-08-29	20	11.1002/1000/14378

Keywords

Fire smoke detection, functional architecture, smart fire smoke detection.

* 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.

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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/.

Table of Contents

Recommendation ITU-T Y.4558

Requirements and functional architecture of smart fire smoke detection service

1 Scope

This Recommendation describes the requirements and functional architecture of the smart fire smoke detection (SFSD) service to improve efficiency of maintenance and management, provide real-time alarms and fault reports and enhance service experience.

The scope of this Recommendation includes:

– Introduction to the SFSD service, including the issues of the traditional fire smoke detection service and the benefits of the SFSD service;

– Requirements of the SFSD service for SFSD device capabilities and SFSD platform capabilities;

– Functional architecture of SFSD devices and the SFSD platform within the SFSD service;

– Implementation and deployment model.

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 application [b-ITU-T Y.2091]: A structured set of capabilities, which provide value-added functionality supported by one or more services, which may be supported by an API interface.

3.1.2 capability [b-ITU-R M.1224-1]: The ability of an item to meet a service demand of given quantitative characteristics under given internal conditions.

3.1.3 device [b-ITU-T Y.4000]: With regard to the Internet of things, this is a piece of equipment with the mandatory capabilities of communication and the optional capabilities of sensing, actuation, data capture, data storage and data processing.

3.1.4 functional entity [b-ITU-T Y.2012]: An entity that comprises an indivisible set of specific functions. Functional entities are logical concepts, while groupings of functional entities are used to describe practical, physical implementations.

3.1.5 internet of things [b-ITU-T Y.4000]: A global infrastructure for the information society, enabling advanced services by interconnecting (physical and virtual) things based on, existing and evolving, interoperable information and communication technologies.

3.1.6 service [b-ITU-T Y.2091]: A set of functions and facilities offered to a user by a provider.

3.1.7 smoke alarm [b-ISO 12239]: Device containing within one housing all the components, except possibly the power source, necessary for detecting smoke and generating an alarm condition.

3.2 Terms defined in this Recommendation

None.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

APP Application

FE Functional Entity

GIS Geographic Information System

IoT Internet of Things

NB-IoT Narrow Band-Internet of Things

SFSD Smart Fire Smoke Detection

SMS Short Message Service

TTS Text to Speech

UI User Interface

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 document 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.

The keywords "**can optionally**" and "**may**" indicate an optional requirement which is permissible, without implying any sense of being recommended. These terms are not intended to imply that the vendor's implementation must provide the option and the feature can be optionally enabled by the network operator/service provider. Rather, it means the vendor may optionally provide the feature and still claim conformance with the specification.

6 Introduction to the smart fire smoke detection service

The fire smoke detection service usually detects the smoke concentration through sensors and sends a fire alarm to prevent fire when the smoke concentration reaches a certain threshold. It is usually deployed in an indoor environment such as residential buildings, factories, shopping malls, hotels, office buildings, teaching buildings, banks, libraries, warehouses, etc.

With the development of society and economy, the fire smoke detection service is playing a more and more important role in people's life. However, some issues exist in the traditional fire smoke detection service as describes below:

- Inefficient maintenance and management:

  It is difficult to realize automatic inspection in the traditional fire smoke detection service. Thus, inspection can be done regularly by professional maintenance personnel. Therefore, on the one hand, this involves high labour costs. On the other hand, device failure cannot be

timely detected and handled. If more and more smoke detection devices are deployed, then more and more professional maintenance personnel are needed, which will cause higher maintenance costs.

- Non-real-time device failure detection

  Due to the lack of network connection capability in the traditional fire smoke detection service, the status of fire smoke detection device cannot be monitored in time, meaning that damages and defects of fire smoke detection devices cannot be detected and handled from the beginning. The status includes the availability of devices, service life of devices, remaining battery capacity, etc. In this case, fire smoke devices are not reliable to guarantee the safety of people's life and property.

- Non-real-time fire alarm notification:

  In case of fire, due to the lack of network connection capability in the traditional fire smoke detection service, fire alarms are not reported in a timely manner to the cloud platform. Therefore, relevant departments and personnel (e.g., fire department, estate management department, security personnel, property owner, etc.) cannot be notified at an early time. Additionally, personnel are not timely notified that they need to evacuate the place.

- Poor service experience:

  Without the benefits of network connection capability and big data analysis, the traditional fire smoke detection service is unable to achieve lower false alarm probability and miss probability. Additionally, it cannot provide accurate device deployment and policy update suggestions, like the deployment density of fire smoke detection device in factories, museums and residential areas, the concentration of fire smoke that triggers the alarm under different environments in different places.

To address these issues of the traditional fire smoke detection service, the smart fire smoke detection (SFSD) service not only detects smoke concentration through sensors, and triggers a fire alarm when it reaches a certain threshold, but it also uses the network to send the alarm information to the cloud platform, thus notifying in a timely manner the relevant departments and personnel through web/APP/SMS/voice/instant message client, etc. The SFSD service can provide the following benefits:

- Efficient maintenance and management:

  The SFSD service not only realizes automatic inspection and timely fault detection in its operation phase, but it also reduces the cost of maintenance and management. Devices can report their status information via a network connection in accordance with the periodicity configured by the platform, and the platform can also actively query the status of devices.

- Real-time alarm reports:

  If a device detects that the concentration of fire smoke reaches the threshold, it will send an alarm report to the platform via a network connection. Therefore, the relevant departments and personnel such as the fire department, the estate management department, security personnel and the property owner can immediately receive an alarm via web/APP/SMS/voice/instant message client.

- Real-time fault reports:

  If a device does not work properly (e.g., due to equipment failure, dismantling alarm, insufficient voltage), it will automatically trigger a fault report and will immediately notify the maintenance personnel via web/APP/SMS/voice/instant message client.

- Good service experience:

  The SFSD service can improve the accuracy of fire smoke detection by connecting more external sensors and accessories such as temperature sensors, illumination intensity sensors,

carbon monoxide sensors, carbon dioxide sensors and cameras to acquire more information on the scene, and also the big data analysis and processing system of the platform can be used to reduce false alarm probability and miss probability. In addition, devices can be controlled remotely and the configuration profile and policy on the devices can be updated remotely online based on requirements. When the buzzer in device starts a fire smoke alarm, and the property owner has been properly notified, the buzzer can be stopped manually or remotely through the platform, and the concentration threshold of the fire smoke that triggers the alarm can also be flexibly adjusted for different environments and different locations.

Based on these observations, this Recommendation describes the service requirements, functional architecture, and core functions of the SFSD service.

7 Requirements of the smart fire smoke detection service

7.1 SFSD device capability requirements

To provide the SFSD services, the following capability requirements on SFSD device are required to be satisfied:

1) Status reporting requirements:
   - SFSD device is required to obtain the status information of the SFSD device.
   - SFSD device is required to regularly send status information of the SFSD device to the SFSD platform.
   - SFSD device is required to send the status information of the SFSD device to the SFSD platform according to the query from the SFSD platform.
2) Alarm reporting requirements:
   - SFSD device is required to monitor the fire smoke concentration of the surrounding environment.
   - SFSD device is required to automatically trigger an alarm on buzzer when the pre-set fire smoke concentration conditions are reached.
   - SFSD device is required to send fire alarm to the SFSD platform when the pre-set fire smoke concentration conditions are reached.
3) Fault reporting requirements:
   - SFSD device is required to obtain the abnormal working status of the SFSD device.
   - SFSD device is required to send fault reports to the SFSD platform.
4) Online remote update requirements:
   - SFSD device is required to receive updated reporting policies from the SFSD platform and replace the existing policies inside the SFSD device.
   - SFSD device is required to receive updated configuration profile from the SFSD platform and replace the existing configuration profile inside the SFSD device.
5) External sensors and accessories access requirements:
   - SFSD device is recommended to be extended to access a wide variety of external sensors and accessories.
   - SFSD device may obtain the status information of external sensors and accessories.
   - SFSD device may regularly send status information of external sensors and accessories to the SFSD platform.

- SFSD device may send the status information of external sensors and accessories to the SFSD platform in accordance with to the query from the platform.
- SFSD device may use cameras to obtain videos and send the videos to the SFSD platform.

7.2 SFSD platform capability requirements

To provide the SFSD services, the following capability requirements on the SFSD platform are required to be satisfied:

1) Status monitoring requirements:
   - SFSD platform is required to receive status information reports from the SFSD devices.
   - SFSD platform is required to identify and confirm the status information from the SFSD devices.
   - SFSD platform may be required to receive the status information reports from external sensors and accessories of SFSD devices.
   - SFSD platform may be required to identify and confirm the status information reports of external sensors and accessories of SFSD devices.
   - SFSD platform is required to provide the status information to the relevant personnel or department via web/APP/SMS/voice/instant message client.
2) Alarm management requirements:
   - SFSD platform is required to receive fire alarm information from SFSD devices.
   - SFSD platform is required to identify and confirm fire alarm information from SFSD devices.
   - SFSD platform is required to trigger a fire alarm automatically and provide fire alarm information to the relevant personnel or department via web/APP/SMS/voice/instant message client.
3) Fault detection requirements:
   - SFSD platform is required to receive fault alarms from SFSD devices.
   - SFSD platform is required to identify and confirm fault alarm reports from SFSD devices.
   - SFSD platform is required to trigger a fault alarm automatically and provide fault alarms to the relevant personnel or department via web/APP/SMS/voice/instant message client.
4) Remote update management requirements:
   - SFSD platform is required to remotely manage the creation, modification and deletion of the profile and policies on SFSD devices.
   - SFSD platform is required to support single SFSD device control and SFSD device group control.
5) Statistics and analysis requirements:
   - SFSD platform is recommended to support statistics and analysis of the status information, fire alarm information and fault alarms for better maintenance and service improvement.
6) Geographic information system (GIS)-based visualization user interface (UI) requirements:
   - SFSD platform is recommended to be able to display the physical distribution, show the state information of SFSD devices on a GIS-based map.

- SFSD platform is recommended to supply a UI control function to send control commands to SFSD devices or SFSD device groups.

NOTE – Control commands include policy and profile adjustment, stopping the buzzer remotely, etc.

7) External platform access requirements:

- SFSD platform is recommended to provide the interfaces with external platforms.

8 Functional architecture of smart fire smoke detection service

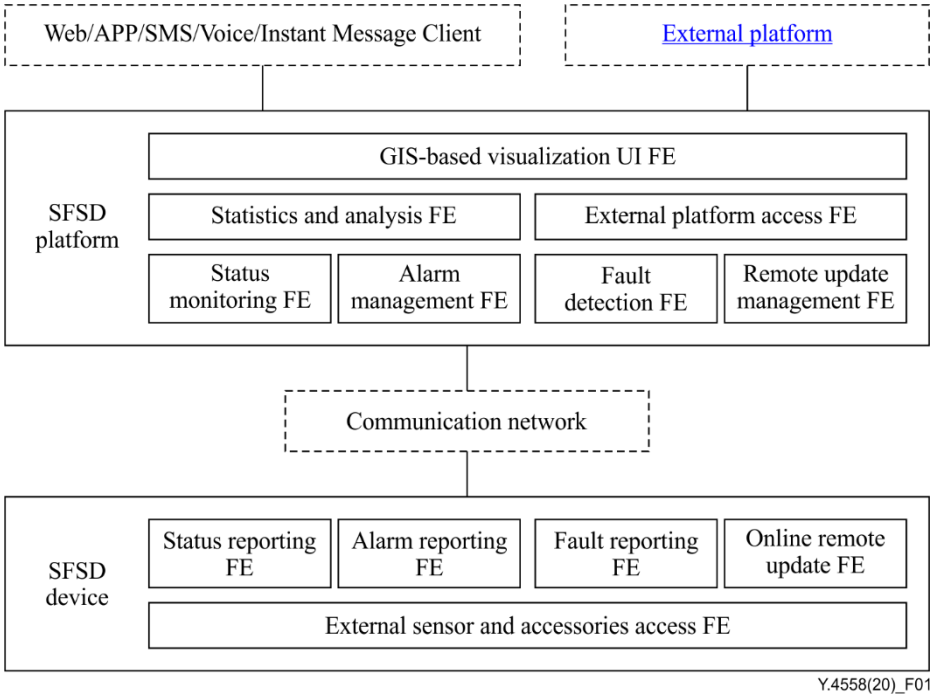

Figure 1 – Functional architecture of smart fire smoke detection service

As shown in Figure 1, the functional architecture of the SFSD service consists of two main parts. One is SFSD platform, and the other is SFSD device. The communication network, external platform and web/APP/SMS/voice/instant messaging client are out of the scope of this Recommendation.

- SFSD device is responsible for the establishment of communication channels, the exchange of data with the SFSD platform and the execution of control commands.
- The communication network is responsible for communications between the SFSD device and the SFSD platform. It can be a wireless network or a wired network.
- SFSD platform is responsible for monitoring and managing the SFSD device remotely, and for providing the SFSD service for the administrators or a third party.
- Web/APP/SMS/voice/instant message client are responsible for allowing administrators or a third party to monitor and manage the SFSD device anytime and anywhere via mobile phone or personal computer.
- The external platform can be connected to the SFSD platform to handle fire alarms such as fire command system.

8.1 SFSD device

SFSD device includes the status reporting functional entity (FE), alarm reporting FE, fault reporting FE, online remote update FE and external sensors & accessories access FE.

8.1.1 Status reporting FE

The main role of the status reporting FE is to provide status information about the SFSD device and external sensors and accessories to the SFSD platform as follows:

- Collect the status information of the SFSD device (e.g., service life of devices, remaining battery power, network signal strength, etc.).
- Collect the status information of the surrounding environment, (e.g., temperature, luminous intensity, fire smoke concentration, etc.).
- Regularly send the status information of the SFSD device and external sensors and accessories to the SFSD platform, in accordance with the period configured by the SFSD platform.
- Send the status information of the SFSD device and external sensors and accessories to the SFSD platform, in accordance with the query from the SFSD platform.

8.1.2 Alarm reporting FE

The main role of the alarm reporting FE is to provide fire alarm to the SFSD platform as follows:

- Monitor the fire smoke concentration of the surrounding environment.
- Automatically trigger an alarm on buzzer, once the pre-set fire smoke concentration conditions are reached.
- Send fire alarm to the SFSD platform, once the pre-set fire smoke concentration conditions are reached.

8.1.3 Fault reporting FE

The main role of the fault reporting FE is to provide the fault information to the SFSD platform as follows:

- Collect the abnormal working status of the SFSD device such as equipment failures, dismantling alarm, insufficient voltage.
- Send fault reports to the SFSD platform.

8.1.4 Online remote update FE

The main role of the online remote update FE is as follows:

- Receive updated configuration profile from the SFSD platform and replace the existing configuration profile inside the SFSD device.
- Receive updated reporting policies from the SFSD platform and replace the existing policies inside the SFSD device.

8.1.5 External sensors & accessories access FE

The main role of the external sensors & accessories access FE is as follows:

- Extend to connect with various external sensors (e.g., temperature sensor, illumination intensity sensor, carbon monoxide sensor and carbon dioxide sensor) and accessories (e.g., camera, Bluetooth and Wi-Fi hotspot).
- Exchange the relevant information or content with external sensors and accessories.

8.2 SFSD platform

The SFSD platform includes the status monitoring FE, alarm management FE, fault detection FE, remote update management FE, statistics & analysis FE, geographical information system (GIS)-based visualization UI FE, and external platform access FE.

8.2.1 Status monitoring FE

The main role of the status monitoring FE is to provide status information about the SFSD device and external sensors and accessories for on time monitoring as follows:

- Monitor the status information of the SFSD device and external sensors and accessories.
- Provide the status information to the relevant personnel or department via web/APP/SMS/voice/instant message client.
- Provide the status information to statistics & analysis FE.

8.2.2 Alarm management FE

The main role of the alarm management FE is to provide the fire alarm information to the relevant personnel or department via Web/APP/SMS/voice/instant message client as follows:

- Identify and confirm the fire alarm report from the SFSD device.
- Automatically trigger a fire alarm and notify the relevant personnel or department via Web/APP/SMS/voice/instant message client.
- Provide the fire alarm information to statistics & analysis FE.

8.2.3 Fault detection FE

The main role of fault detection FE is to provide the fault information for quick trouble shooting as follows:

- Monitor the abnormal working status of the SFSD device, like equipment failures, dismantling alarm, insufficient voltage.
- Identify the fault of the SFSD device once the pre-set fault conditions are reached.
- Identify the disconnection of the SFSD device once the pre-set disconnection conditions are reached.
- Generate the fault report once SFSD device is identified as faulty or disconnected.
- Automatically trigger a fault alarm and notify the maintenance personnel via web/APP/SMS/voice/instant message client.
- Provide the fault information to the statistics & analysis FE.

8.2.4 Remote update management FE

The main role of the remote update management FE is to manage the creation, modification and deletion of the profile and policies on the SFSD device as follows:

- Update the configuration profile of the SFSD devices.
- Create, modify and delete the status report policies, the fire alarm report policies and the fault report policies.
- Send the configuration profile and policies information to relevant SFSD device.

8.2.5 Statistics & analysis FE

The main role of the statistics & analysis FE is to provide relevant reports for better maintenance and service improvement as follows:

- Obtain the real-time data from the status monitoring FE, alarm management FE and fault detection FE.
- Analyse data statistics for better maintenance and service improvement.
- Provide reports according to big data analysis.

8.2.6 GIS-based visualization UI FE

The main role of GIS-based visualization UI FE is to display information about the SFSD device intuitively on a map, and supply UI control function to control the SFSD device or SFSD device group as follows:

- Display the physical distribution of each SFSD device on the GIS-based map.
- Display the working status of each SFSD device, such as connected/disconnected, faulty.
- Display the fault and alarm information about each SFSD device.
- Supply UI control function to control the SFSD device or SFSD device group on demand, such as adjusting the policy or stopping the buzzer after the fire alarm is eliminated.

8.2.7 External platform access FE

The main role of the external platform access FE is as follows:

- Connect with external platform via interfaces.
- Exchange the relevant information or content with external platform.

9 Implementation and deployment model of the smart fire smoke detection service

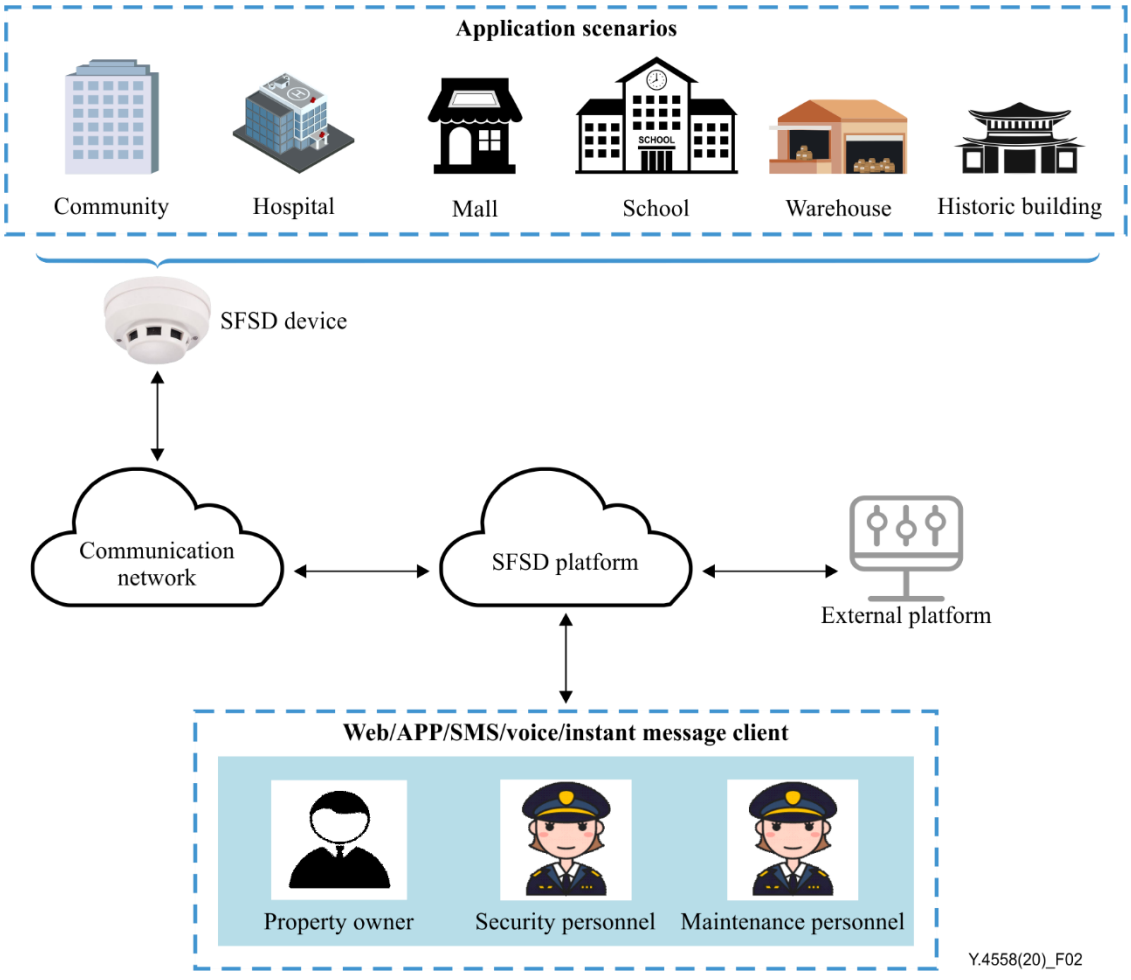

Figure 2 – Implementation and deployment model of smart fire smoke detection service

Figure 2 shows the implementation and deployment model of the SFSD service. In this model, the SFSD device may be deployed in many application scenarios, e.g., community, hospital, mall, school, warehouse or historic building. The SFSD device may be connected to the SFSD platform via a wired or a wireless communication network. Property owner, security personnel and maintenance personnel may access the SFSD platform via web/APP/SMS/voice/instant message client. An external platform such as a fire command system may be connected to the SFSD platform to handle the fire alarm. The four service flows described in clause 9.1 to 9.4 are given in order to ensure this model works well.

9.1 Periodic status monitoring of the SFSD device

This procedure shows the flow of the periodic status report described in Figure 3.

The main steps are outlined as follows:

Step 1: SFSD device sends the status report to the SFSD platform according to a fixed period. This fixed period is pre-set or configured by the SFSD platform.

Step 1a: SFSD device sends the status report according to a fixed period. This fixed period is pre-set or configured by SFSD platform.

Step 1b: The communication network forwards the status report to the SFSD platform.

NOTE – SFSD device can send the status report to SFSD platform directly or forwarded by a communication network.

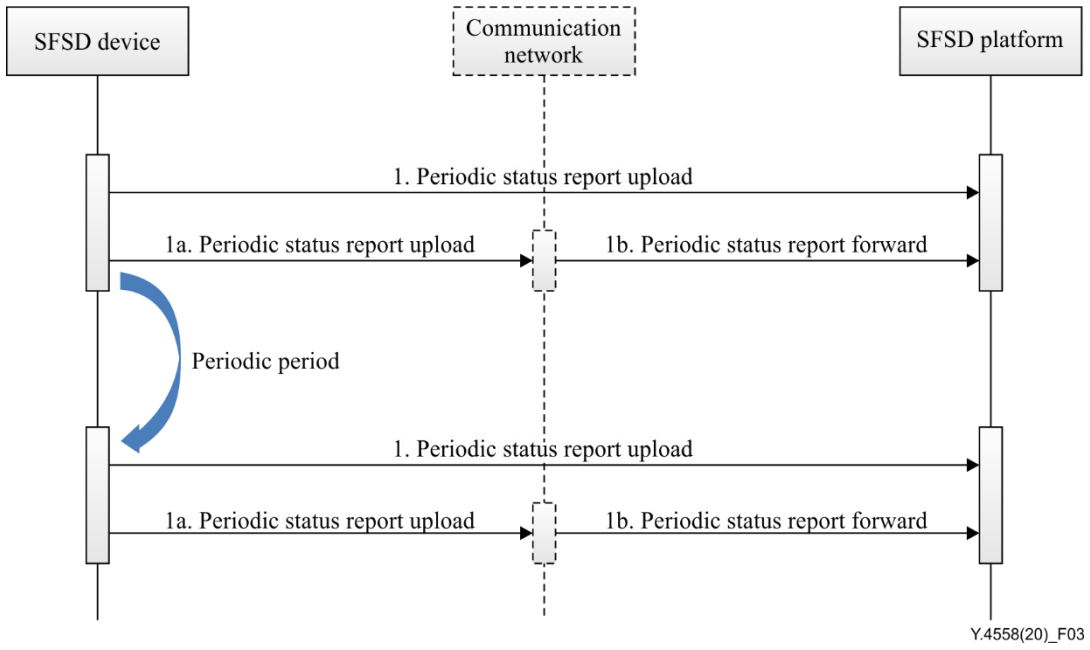

Figure 3 – Flow for periodic status report

9.2 Real-time alarm report of the SFSD device

The following procedure shows the flow of a real-time alarm report as described in Figure 4.

The main steps are as follows:

Condition: SFSD device automatically triggers an alarm on buzzer once the pre-set fire smoke concentration conditions are reached.

Step 1: SFSD device immediately sends the real-time alarm report to the SFSD platform.

Step 1a: SFSD device immediately sends the real-time alarm report.

Step 1b: The communication network forwards the real-time alarm report to the SFSD platform.

NOTE – SFSD device can send the real-time alarm report to SFSD platform directly or via a communication network.

Step 2: SFSD platform forwards the real-time alarm report indication to external platform, property owner and security personnel.

Step 3: Based on the real-time alarm report indication, external platform carries out firefighting action.

Step 4: After the external platform has handled this fire, it sends a fire handled indication to the SFSD platform.

Step 5: SFSD platform sends the fire handled indication to the property owner and security personnel.

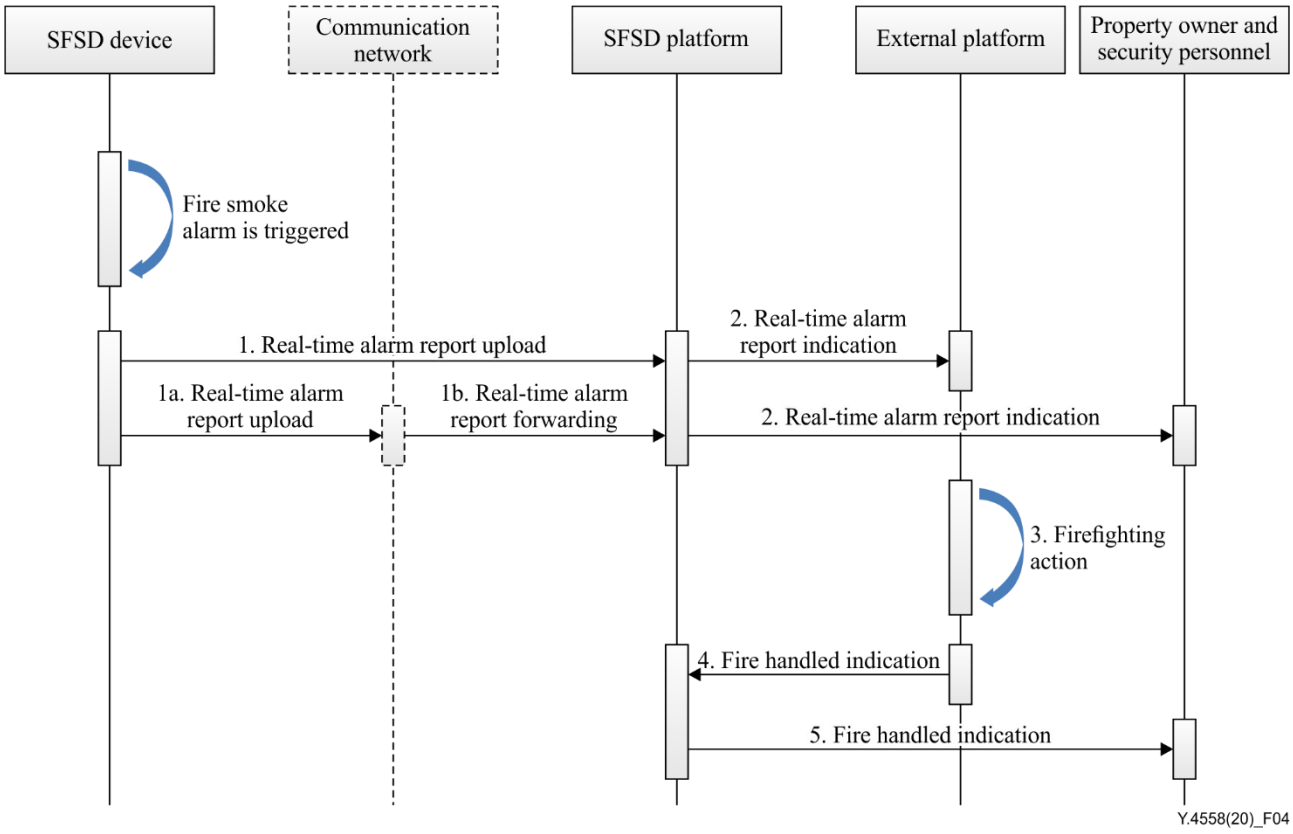

Figure 4 – Flow for real-time alarm report

9.3 Real-time faults report of SFSD device

This procedure shows the flow of real-time fault reports as described in Figure 5.

The main steps are outlined as follows:

Condition: The abnormal working status of SFSD device is detected.

Step 1: SFSD device immediately sends the real-time fault report to the SFSD platform.

Step 1a: SFSD device immediately sends the real-time fault report.

Step 1b: Communication network forwards the real-time faults report to SFSD platform.

NOTE – SFSD device can send the real-time fault report to the SFSD platform directly or via a communication network.

Step 2: SFSD platform forwards the real-time fault report indication to the property owner, security personnel and maintenance personnel.

Step 3: Based on the real-time fault report indication, the SFSD device is checked and repaired by maintenance personnel.

Step 4: After maintenance personnel have repaired the SFSD device, it sends an SFSD device repaired indication to the SFSD platform.

Step 5: SFSD platform sends an SFSD device repaired indication to the property owner and security personnel.

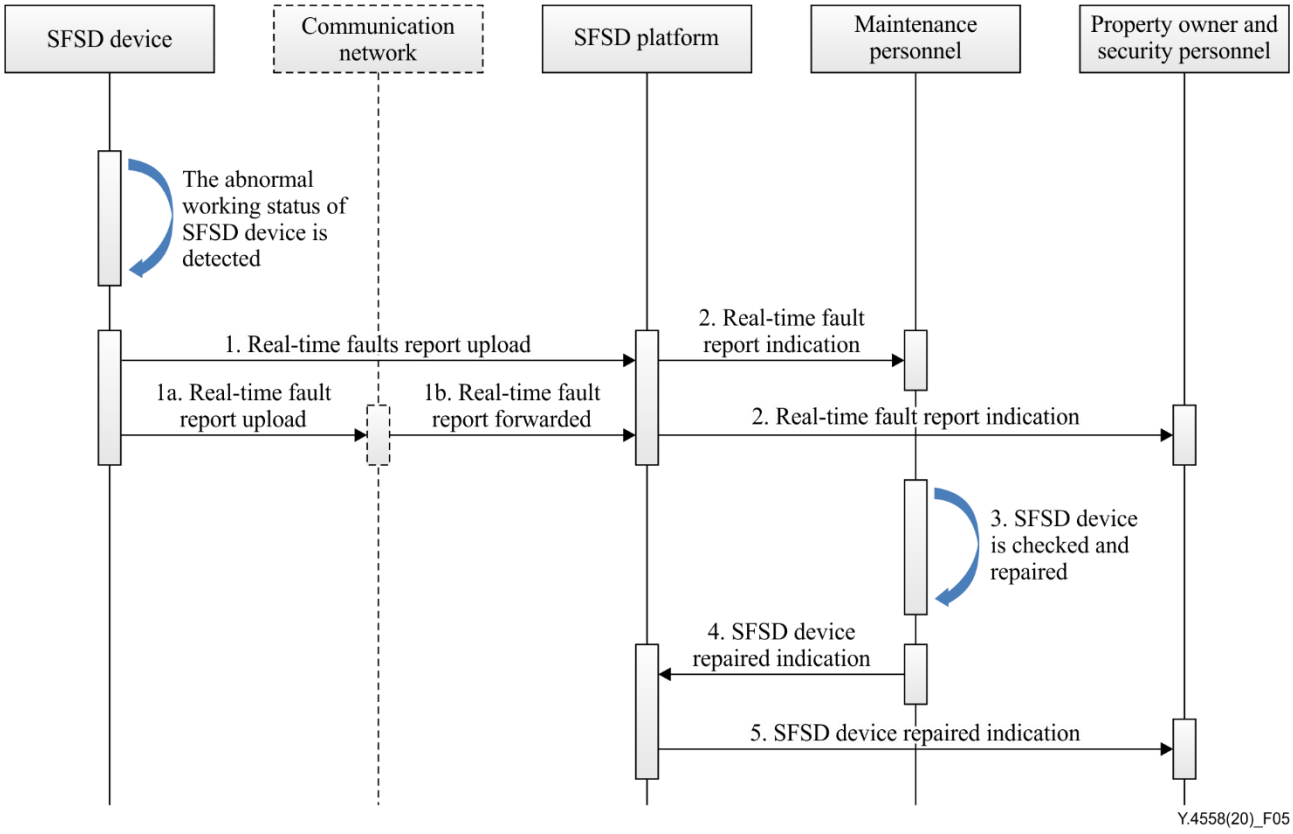

Figure 5 – Flow for real-time faults report

9.4 Remote update of the SFSD device

This procedure shows the flow of remote control as described in Figure 6.

The main steps are outlined as follows:

Step 1: SFSD platform sends the configuration profile and policies information to the SFSD device.

Step 1a: SFSD platform sends the configuration profile and policies information.

Step 1b: The communication network forwards the configuration profile and policies information to the SFSD device.

NOTE – SFSD platform can send the configuration profile and policies information to the SFSD device directly or forwarded by a communication network.

Step 2: SFSD device updates the configuration profile and policies information.

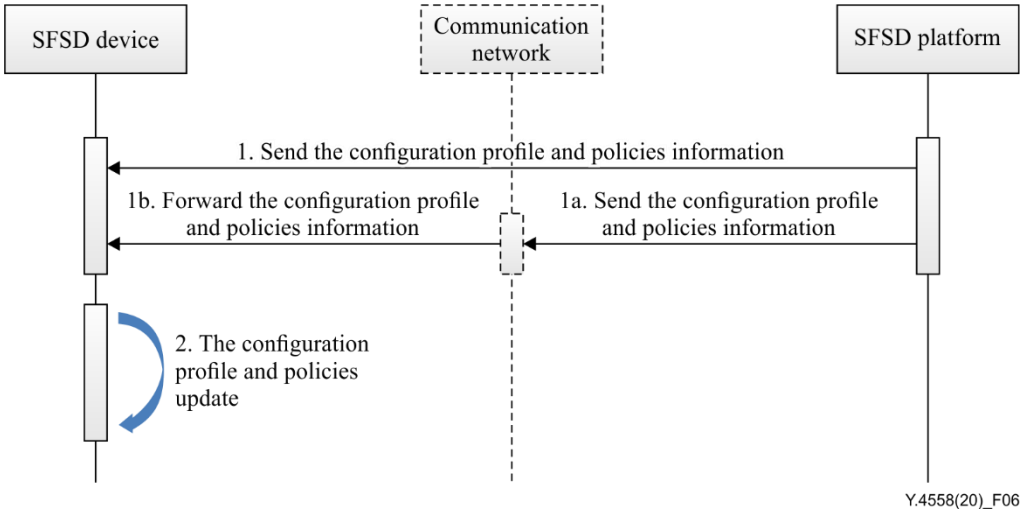

Figure 6 – Flow for remote update

Appendix I

An implementation and deployment example of the smart fire smoke detection service

(This appendix does not form an integral part of this Recommendation.)

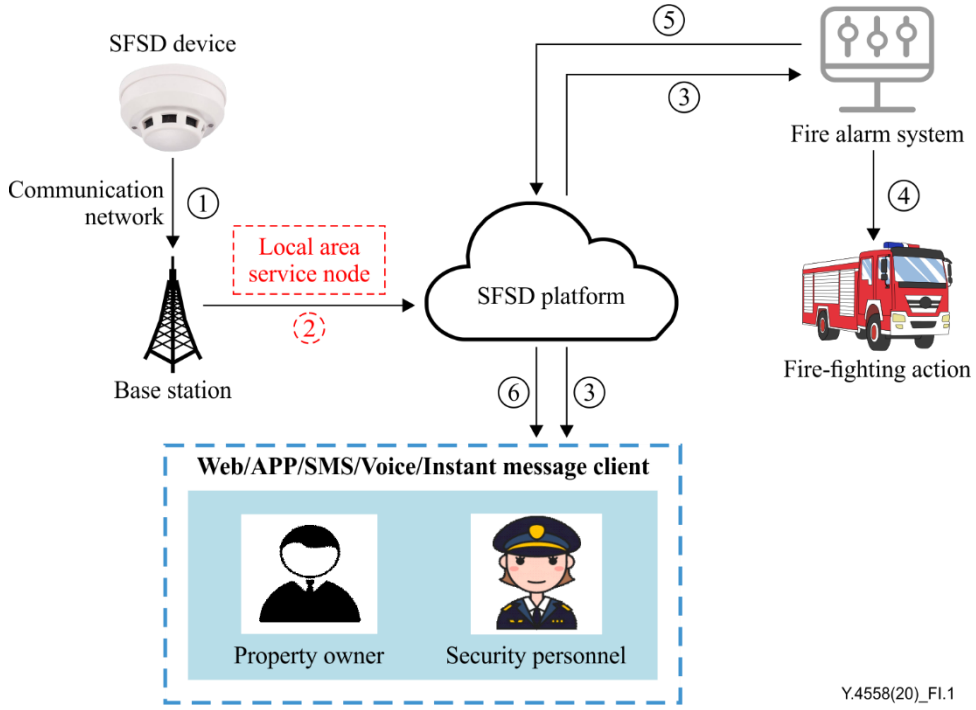

Figure I.1 – An implementation and deployment example of the smart fire smoke detection service

An example deployment model of SFSD service based on cellular network narrow band-Internet of things (NB-IoT) [b-3GPP TS 36.300] is shown in Figure I.1, this example follows the flow described in clause 9. In this model, the SFSD device is an NB-IoT smart fire smoke detector, and the SFSD platform contains the IoT cloud platform and platform management system. The fire command system is connected to an IoT cloud platform as external platform. In this SFSD platform system, the IoT cloud platform acts as status monitoring FE, alarm management FE, fault detection FE, statistics & analysis FE and external platform access FE, and the platform management system acts as remote update management FE and GIS-based visualization UI FE. The SFSD device and SFSD platform can be connected through NB-IoT communication network, and the SFSD platform can send the messages to web/APP/SMS/voice/instant message client. The fire command system is used to receive the alarm data from IoT cloud Platform and give the feedback of fire action, while the platform management system can be used to management the IoT cloud platform and supply GIS-based visualization UI show.

The service process is illustrated as follows:

1. NB-IoT SFSD device obtains data and sends them to the operator IoT platform via NB-IoT base station. The data includes the status information of the detectors, abnormal working status of detectors and fire smoke concentration of the surrounding environment. The SFSD device will automatically trigger an alarm on buzzer when the pre-set fire smoke concentration conditions are reached through the built-in main control chip.

2. Data flow is transmitted from operator IoT platform to IoT cloud platform. The IoT cloud platform analyses the amount and concentration of smoke. Once confirmed, the smoke alarm/fire alarm signal will be issued.
3. IoT cloud platform pushes the alarm data to the fire command system and the fire event subscriber such as the property owner and security personnel. According to the business requirements of the alarm, the IoT cloud platform pushes SMS and text to speech (TTS) voice to the mobile phones of property owners and security personnel. Meanwhile, an alarm dialog box pops up in the monitoring platform of the platform management system.
4. After receiving the alarm on the fire command system, a firefighting action is immediately started, and after receiving the alarm on the phone, the property owners and safety personnel shall evacuate the premises and deal with the fire.
5. After this fire is handled by a fire-fighting action, the fire command system will send a fire handled indication to the IoT cloud platform.
6. The IoT cloud platform has cancelled the fire alarm, and sends a fire handled indication to the fire event subscriber such as the property owner and security personnel.

In this SFSD service example, the user can manage the SFSD device by subscribing the service on the IoT cloud platform, such as binding the phone number, testing the working status of the devices, obtaining all kinds of help, etc. The user can use APP to bind the SFSD device with the mobile phone number, as well as mobile phone numbers of other different roles such as family members, property owners and security personnel.

In addition, IoT cloud platform can remotely manage the creation, modification and deletion of the profile and policies on the SFSD device through the platform management system.

Bibliography

[b-ITU-T Y.2012] Recommendation ITU-T Y.2012 (2010), *Functional requirements and architecture of next generation networks*.

[b-ITU-T Y.2091] Recommendation ITU-T Y.2091 (2011), *Terms and Definitions for Next Generation Networks*.

[b-ITU-T Y.4000] Recommendation ITU-T Y.4000/Y.2060 (2012), *Overview of the Internet of things*.

[b-ITU-R M.1224-1] Recommendation ITU-R M.1224-1 (2012), *Vocabulary of terms for International Mobile Telecommunications (IMT)*.

[b-3GPP TS 36.300] Technical Specification 3GPP TS 36.300 V14.7.0 (2018-06), *Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Overall description; Stage 2(Release 14))*.

[b-ISO 12239] ISO 12239:2010, *Smoke Alarms Using Scattered Light, Transmitted Light or Ionization*.

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