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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 –
Frameworks, architectures and protocols

Requirements and framework for smart livestock farming based on the Internet of things

Recommendation ITU-T Y.4482

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Recommendation ITU-T Y.4482

Requirements and framework for smart livestock farming based on the Internet of things

Summary

Smart livestock farming (SLF) is a convergence service in which information and communication technologies (ICTs) are applied to livestock value chains. It has the potential to deliver more productive and sustainable production by integrating processes of smart farming, management information systems (MISs), stockbreeding automation and robotics to provide better decision-making or more effective exploitation operations and management of livestock value chains.

The use of Internet of things (IoT) technologies in SLF aims at providing full coverage of processes by collecting and transmitting data from the entire agroecosystem. That means SLF can establish contact with each participant of a livestock chain, providing and collecting information about their processes and increasing the possibilities for control and improvement on the efficiency of their tasks.

Recommendation ITU-T Y.4482 provides an overview of SLF based on IoT, high-level requirements for SLF and a reference model which represents a generic sequence for livestock value chains and is applicable to these chains as a whole, regardless of species or rearing techniques.

History

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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.

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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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Recommendation ITU-T Y.4482

Requirements and framework for smart livestock farming based on the Internet of things

1 Scope

This Recommendation provides an overview of smart livestock farming (SLF) based on IoT, high-level requirements for SLF and a reference model which represents a generic sequence for livestock value chains.

SLF is a convergence service in which information and communication technologies (ICTs) are applied to the livestock value chains. It has the potential to deliver more productive and sustainable production by integrating processes of smart farming, management information systems (MISs), stockbreeding automation and robotics to provide better decision-making or more effective exploitation operations and management of livestock value chains.

The scope of this Recommendation includes:

- an overview of SLF;
- an SLF conceptual model;
- high-level requirements of SLF;
- a reference model for SLF from the perspective of the IoT; and
- security considerations.

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.

- [ITU-T L.1504] Recommendation ITU-T L.1504 (2016), *ICT and adaptation of agriculture to the effects of climate change*.
- [ITU-T Y.3041] Recommendation ITU-T Y.3041 (2013), *Smart ubiquitous networks – Overview*.
- [ITU-T Y.3500] Recommendation ITU-T Y.3500 (2014) | ISO/IEC 17788:2014, *Information technology – Cloud computing – Overview and vocabulary*.
- [ITU-T Y.4000] Recommendation ITU-T Y.4000/Y.2060 (2012), *Overview of the Internet of things*.
- [ITU-T Y.4100] Recommendation ITU-T Y.4100/2066 (2014), *Common requirements of the Internet of things*.
- [ITU-T Y.4113] Recommendation ITU-T Y.4113 (2016), *Requirements of the network for the Internet of things*.
- [ITU-T Y.4208] Recommendation ITU-T Y.4208 (2020), *Internet of things requirements for support of edge computing*.

- [ITU-T Y.4401] Recommendation ITU-T Y.4401/2068 (2015), *Functional framework and capabilities of the Internet of things*.
- [ITU-T Y.4450] Recommendation ITU-T Y.4450 (2015), *Overview of smart farming based on networks*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 access network [b-ITU-T Q.1742.1]: A network that connects access technologies (such as a radio access network) to the core network.

3.1.2 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.

3.1.3 context [b-ITU-T Y.2002]: The information that can be used to characterize the environment of a user.

3.1.4 core network [b-ITU-T Y.101]: A portion of the delivery system composed of networks, systems equipment and infrastructures, connecting the service providers to the access network.

3.1.5 device [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.

3.1.6 gateway [b-ITU-T Y.4101]: A unit in the Internet of Things which interconnects the devices with the communication networks. It performs the necessary translation between the protocols used in the communication networks and those used by devices.

3.1.7 Internet of things [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.

NOTE 1 – Through the exploitation of identification, data capture, processing and communication capabilities, the IoT makes full use of things to offer services to all kinds of applications, whilst ensuring that security and privacy requirements are fulfilled.

NOTE 2 – From a broader perspective, the IoT can be perceived as a vision with technological and societal implications.

3.1.8 IoT area network [ITU-T Y.4113]: A network of devices for the IoT and gateways interconnected through local connections.

3.1.9 object [b-ITU-T Y.2002]: An intrinsic representation of an entity that is described at an appropriate level of abstraction in terms of its attributes and functions.

3.1.10 sensor [ITU-T Y.4113]: An electronic device that senses a physical condition or chemical compound and delivers an electronic signal proportional to the observed characteristic.

3.1.11 sensor node [b-ITU-T Y.4105]: A device consisting of sensor(s) and optional actuator(s) with capabilities of sensed data processing and networking.

3.1.12 smart farming based on networks [ITU-T Y.4450]: A service that uses networks to actualize a convergence service in the agricultural field to attain more efficiency and quality improvement and to cope with various problems.

3.1.13 thing [ITU-T Y.4000]: In the Internet of things, this is an object of the physical world (physical things) or the information world (virtual things), which is capable of being identified and integrated into the communication networks.

3.1.14 ubiquitous networking [ITU-T Y.4450]: The ability for persons and/or devices to access services and communicate while minimizing technical restrictions regarding where, when and how these services are accessed, in the context of the service(s) subscribed to.

NOTE – Although technical restrictions to access services and communicate may be minimized, other constraints such as regulatory, national, provider and environmental constraints may impose further restrictions.

3.2 Terms defined in this Recommendation

This Recommendation defines the following term:

3.2.1 smart livestock farming: A convergence service which applies information and communication technologies (ICTs) to livestock value chains, with the potential to deliver more productive and sustainable production.

NOTE 1 – By integrating processes of smart farming, management information systems, stockbreeding automation and robotics, smart livestock farming helps decision-making for more effective and efficient exploitation, operations and management of livestock value chains.

NOTE 2 – Examples of products from domesticated animals (excluding pets) are meat, eggs, milk, honey, fur, leather and wool.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

EC	Edge Computing
ICT	Information and Communication Technology
IoT	Internet of Things
LBS	Location-Based Services
MIS	Management Information Systems
NGN	Next Generation Network
RFID	Radio Frequency Identification
SLF	Smart Livestock Farming

5 Conventions

The following conventions are used in this Recommendation:

- The keywords "is required to" and "must" 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.
- The keywords "can optionally" and "may" indicate an optional requirement that is permissible, without implying any sense of being recommended. This term is 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 Overview of SLF

Smart livestock farming (SLF) is a concept that refers to modern ICT applied to livestock value chains. It has the potential to deliver more productive and sustainable production by integrating

