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DIN EN ISO 11073-10471:2011-07

Entwurf

Medizinische Informatik – Interoperabilität von Geräten – Teil 10471: Kommunikation von Geräten für die persönliche Gesundheit – Gerätespezifikation – Schnittstellenkonzentrator und -umsetzer für assistierende Systeme (ISO/IEEE FDIS 11073-10471:2024); Englische Fassung prEN ISO IEEE 11073-10471:2024

Health informatics –
Device interoperability –
Part 10471: Personal health device communication – Device specialization – Independent living activity hub (ISO/IEEE FDIS 11073-10471:2024);
English version prEN ISO IEEE 11073-10471:2024

Informatique de santé –
Interopérabilité des dispositifs –
Partie 10471: Communication entre dispositifs de santé personnels – Spécialisation du dispositif – Concentrateur d'activité pour une vie autonome (ISO/IEEE FDIS 11073-10471:2024);
Version anglaise prEN ISO IEEE 11073-10471:2024

Anwendungswarnvermerk

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Gesamtumfang 129 Seiten

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Nationales Vorwort

Dieses Dokument (prEN ISO IEEE 11073-10471:2024) wurde vom Technischen Komitee ISO/TC 215 „Health informatics“ in Zusammenarbeit mit dem Technischen Komitee CEN/TC 251 „Medizinische Informatik“ (Sekretariat NEN, Niederlande) erarbeitet.

Für Deutschland hat hieran der Arbeitsausschuss NA 176-02-02 AA „Interoperabilität“ im DIN-Normenausschuss Gesundheitstechnologien (NAGesuTech) mitgearbeitet.

Dieses Dokument enthält unter Berücksichtigung des Präsidialbeschlusses 13/1983 den englischen Originaltext der Internationalen Norm EN ISO/IEEE 11073-10471:2011. Die Internationale Norm wurde in der WG 7 „Devices“ des ISO/TC 215 „Health informatics“ in Zusammenarbeit mit dem IEEE „Institute of Electrical and Electronics Engineers“ erarbeitet und parallel im CEN/TC 251 „Medizinische Informatik“ abgestimmt. Der NA 063-07-02 AA „Interoperabilität“ des Fachbereichs 7 „Medizinische Informatik“ des Normenausschusses Medizin im DIN hat an der Erarbeitung mitgewirkt.

Der Bedarf für eine Deutsche Fassung wird derzeit beraten.

Für die in diesem Dokument zitierten Dokumente wird im Folgenden auf die entsprechenden deutschen Dokumente hingewiesen:

IEEE Std 11073-20601:2008	siehe	DIN EN ISO 11073-20601:2011-07
ISO IEEE 11073-10101:2020	siehe	DIN EN ISO 11073-10101:2021-01

Zusammenfassung

Die ISO/IEEE 11073-Standardfamilie ermöglicht die Datenübertragung zwischen Medizingeräten und Computersystemen. Sie erlaubt die automatisierte, detaillierte Erfassung von personenbezogenen Vitaldaten und Funktionsparametern durch die Verwendung von Überwachungs- und Therapiegeräten — beispielsweise auf einer Intensivstation oder im Operationssaal, aber auch im häuslichen oder privaten Umfeld. Die primären Ziele dabei sind:

— Bereitstellung von „Plug-and-Play“-Funktionalität und Interoperabilität mit Patienten verbundener bzw. personenbezogener Medizingeräte für Realzeitanwendungen.

— Vereinfachung des effizienten Austausches gemessener Vitaldaten, relevanter Kontextinformation sowie Betriebsdaten der verwendeten Medizingeräte.

„Realzeit” bedeutet hier, dass Daten von ggf. mehreren, verschiedenartigen Medizingeräten zeitgenau erfasst und in Bruchteilen von Sekunden dargestellt oder verarbeitet werden können. „Plug-and-Play“ bedeutet, dass Anwender lediglich die Kommunikationsverbindung zu einem Gerät herstellen müssen. Automatisch, d. h. ohne menschlichen Eingriff, erfolgen dessen Erkennung durch das System, die Konfiguration von Kommunikationsparametern sowie gegebenenfalls der Applikation und schließlich die Aufnahme der Datenübertragung.

Diese Norm legt innerhalb der ISO/IEEE 11073-Standardfamilie für die Kommunikation gesundheitsbezogener Geräte eine verbindliche Definition für die Kommunikation zwischen Schnittstellenkonzentratoren und -umsetzern für assistierende Systeme und Manager-Geräten (wie mobilen Telefonen, Arbeitsplatzrechnern, gesundheitsbezogenen persönlichen Geräten, Settop-Boxen) derart fest, dass „Plug-and-Play“-Interoperabilität ermöglicht wird. Sie benutzt Teile existierender Normen, insbesondere ISO/IEEE 11073 Normen zu Terminologie, und Informationsmodellen. Diese Norm legt die Verwendung bestimmter Codes, Formate und Verhaltensweisen in telemedizinischen Umgebungen fest und schränkt Optionalität in den zugrundeliegenden Rahmenbedingungen ein, um Interoperabilität zu erleichtern. Diese Norm legt

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gemeinsame Kernfunktionen für die Kommunikation von Schnittstellenkonzentratoren und -umsetzern für assistierende Systeme fest.

Im vorliegenden Kontext werden Schnittstellenkonzentratoren und -umsetzer für assistierende Systeme als Geräte verstanden, die mit einfachen Sensoren zur Situationserfassung (binären Sensoren) kommunizieren, von einfachen Sensoren gelieferte Umgebungsinformationen normalisieren und die normalisierten Informationen einem oder mehreren Manager-Geräten zur Verfügung stellen. Diese Informationen können z. B. ausgewertet werden, um zu prüfen, ob Aktivität oder Befindlichkeit einer Person derart signifikant von deren normalem Zustand abweichen, dass Dritte benachrichtigt werden müssen. In der ersten, vorliegenden Fassung dieser Norm wird davon ausgegangen, dass Schnittstellenkonzentratoren und -umsetzer für assistierende Systeme normalisierte Informationen für folgende einfache Sensoren zur Situationserfassung (binäre Sensoren) erzeugen: Fallsensoren, Bewegungssensoren, Türsensoren, Bett-/Stuhlbelegungssensoren, Lichtschaltersensoren, Rauchsensoren, (Raum-) Temperaturgrenzwertsensoren, persönliche Notfallrufsysteme und Bettnässesensoren.

Diese Norm entspricht der Notwendigkeit eines offen definierten, unabhängigen Standards für den geregelten Austausch von Informationen zwischen persönlichen gesundheitsbezogenen Geräten und Datenverarbeitungsgeräten (wie mobilen Telefonen, Arbeitsplatzrechnern, gesundheitsbezogenen persönlichen Geräten, Settop-Boxen). Interoperabilität ist der Schlüssel zum Wachstum des potentiellen Markts für diese Geräte und ermöglicht, dass sich Menschen besser informieren und stärker an ihrer gesundheitlichen Betreuung beteiligen.

Aktuelle Informationen zu diesem Dokument können über die Internetseiten von DIN (www.din.de) durch eine Suche nach der Dokumentennummer aufgerufen werden.

Änderungen

Gegenüber DIN EN ISO 11073-10471:2011-07 wurden folgende Änderungen vorgenommen:

a) Sensoren für aktuelle Werte (Temperatur, Luftfeuchte, Energieverbrauch) hinzugefügt;

b) Feuchte-Alarm-Sensor hinzugefügt;

c) Unterstützung für Standortsensoren hinzugefügt;

d) Unterstützung für Base-Offset-Time hinzugefügt;

e) neue Standortkennungen hinzugefügt;

f) Übernahme von Standortkennungen aus den ZigBee-Profilen für Hausautomatisierung und Gesundheitswesen;

g) neue Gerätebezeichner hinzugefügt;

h) Wechsel von Bitstrings zu einfachen OIDs, um Ereignisse zu melden;

i) Aktualisierung des Beispiels auf einfache OID;

j) ergänzende Typen geändert zu obere 11 Bits für den Ort und untere 5 Bits für die Nummer, um mehr Codes innerhalb der Partition zu unterstützen;

k) die Version dieser Gerätespezialisierung aktualisiert;

l) Aktualisierung der Assoziationsdetails basierend auf der neuen Version;

m) Aktualisierung des Wortlauts in 6.3 in Bezug auf „Not Allowed“ und „Observational“;

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n) systematische Namen hinzugefügt;

o) Manipulationserkennungsflagge wurde zu einer allgemeinen Gesundheitsstatusflagge für alle Sensoren;

p) Aufzählungscodes für andere Systeme (ZigBee) bereitgestellt;

q) Standort-RefId-Diskriminator von Klammern auf Unterstrich geändert ((3)-> 3);

r) Begegnungsobjekt hinzugefügt.

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Nationaler Anhang NA
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Begriffe

Reihenfolge und Inhalt der folgenden Begriffe sind identisch mit denen im Abschnitt Begriffe der Englischen Fassung.

Für die Anwendung dieses Dokuments gelten die folgenden Begriffe.

ISO und IEC stellen terminologische Datenbanken für die Verwendung in der Normung unter den folgenden Adressen bereit:

— ISO Online Browsing Platform: verfügbar unter https://www.iso.org/obp

— IEC Electropedia: verfügbar unter https://www.electropedia.org/

3.1
Agent
Knoten, der persönliche Gesundheitsdaten sammelt und an einen angeschlossenen Manager weiterleitet

3.2
Klasse
im objektorientierten Modell beschreibt eine Klasse die Attribute, Methoden und Ereignisse, die Objekte benutzen, welche aus dieser Klasse instantiiert werden

3.3
Verarbeitungsmaschine
siehe: **Manager**

3.4
Gerät
physikalische Apparatur, die entweder eine Agenten- oder eine Managerrolle wahrnimmt

3.5
Dateinummer
en **handle**
vorzeichenlose 16-bit-Zahl, die lokal einmalig vergeben wird und der Identifizierung der Objektinstanz in einem Agenten dient

3.6
Manager
Knoten, der Daten von einem oder mehreren angeschlossenen Agentensystem erhält. Manager können z. B. auch mobile Telefone, gesundheitsbezogene Geräte, Digitalempfänger oder Computersysteme sein

3.7
Objekt-Handle
siehe: **Dateinummer**

3.8
Objekt
in der objektorientierten Modellierung, eine besondere Instantiierung einer Klasse. Die Instantiierung legt Attribute, Methoden und Ereignisse der Klasse fest

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3.9
persönliches gesundheitsbezogenes Gerät
Gerät, das für persönliche gesundheitsbezogene Anwendungen verwendet wird

3.10
persönliches telemedizinisches Gerät
siehe: **persönliches gesundheitsbezogenes Gerät**

3.11
Sensor
Apparat zur Messung physikalischer Eigenschaften. Hierzu gehören auch die grundlegenden Eingangswerte für Agenten in AAL-Anwendungen (insbes. „Independent Living Activity Hub“)

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Nationaler Anhang NB
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Akronyme und Abkürzungen

APDU	Dateneinheit des Anwendungsprotokolls (en: application protocol data unit)
ASN.1	abstrakte Syntax-Notation Eins (en: abstract syntax notation one)
DIM	Domäneninformationsmodell (en: domain information model)
EUI-64	erweiterter eindeutiger Bezeichner (en: extended unique identifier), (64 bit)
ICS	Erklärung zur Konformität der Implementierung (en: implementation conformance statement)
MDC	Kommunikation medizinischer Geräte (en: medical device communication)
MDER	Kodierungsregeln für Medizinprodukte (en: medical device encoding rules)
MDS	Medizingerätesystem (en: medical device system)
MOC	verwaltete Objektklasse (en: managed object class)
OID	Objektbezeichner (en: object identifier)
PDU	Protokolldateneinheit (en: protocol data unit)
PERS	persönliches Notfallrufsystem (en: personal emergency response system)
PHD	persönliches gesundheitsbezogenes Gerät (en: personal health device)
PIR	passives Infrarot (en: passive infrared)
RT-SA	Realzeit-Proben-Array (en: real-time sample array)
VMO	virtuelles medizinisches Objekt (en: virtual medical object)
VMS	virtuelles medizinisches System (en: virtual medical system)

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Nationaler Anhang NC
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Literaturhinweise

DIN EN ISO 11073-10101:2021-01, *Medizinische Informatik — Geräteinteroperabilität — Teil 10101: Kommunikation patientennaher medizinischer Geräte — Nomenklatur (ISO/IEEE 11073-10101:2020); Englische Fassung EN ISO 11073-10101:2020, nur auf CD-ROM*

DIN EN ISO 11073-20601:2011-07, *Medizinische Informatik — Kommunikation von Geräten für die persönliche Gesundheit — Teil 20601: Anwendungsprofil — Optimiertes Datenübertragungsprotokoll (ISO/IEEE 11073-20601:2010); Englische Fassung EN ISO 11073-20601:2011*

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Foreword

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ISO/IEEE 11073-10471 was prepared by the IEEE 11073 Standards Committee of the IEEE Engineering in Medicine and Biology Society (as IEEE Std 11073-10471) and drafted in accordance with its editorial rules. It was adopted, under the “fast-track procedure” defined in the Partner Standards Development Organization cooperation agreement between ISO and IEEE, by Technical Committee ISO/TC 215, *Health informatics*.

This second edition cancels and replaces the first edition (ISO/IEEE 11073-10471:2010), which has been technically revised.

The main changes are as follows:

— added current value sensors (temperature, humidity, utility usage);
— added humidity alert sensor;
— added support for location sensors;
— added support for Base-Offset-Time;

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— added new location identifiers;

— incorporated location identifiers from ZigBee Home Automation and Health Care profiles;

— added new appliance identifiers;

— changed from bit string to simple OIDs to report events;

— updated the example to simple OID;

— changed supplementary types to have upper 11 bits for location and lower 5 bits for number to support more codes within partition;

— updated the version of this device specialization;

— updated the association details based on new version;

— updated the wording in 6.3 regarding the Not Allowed and Observational;

— added systematic names;

— tamper detected flag made a general health status flag for all sensors;

— enumeration codes provided to other systems (ZigBee);

— location RefId discriminator changed from parentheses to underscore ((3)->_3);

— encounter object added.

A list of all parts in the ISO 11073 series can be found on the ISO website.

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.

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Abstract: Within the context of the ISO/IEEE 11073 family of standards for device communication, a normative definition of communication between personal telehealth independent living activity hub devices and compute engines (e.g., cell phones, personal computers, personal health appliances, set top boxes) in a manner that enables plug-and-play interoperability is established in this standard. Appropriate portions of existing standards, including ISO/IEEE 11073 terminology, information models, application profile standards, and transport standards are leveraged. The use of specific term codes, formats, and behaviors in telehealth environments restricting optionality in base frameworks in favor of interoperability are specified. A common core of communication functionality for personal telehealth independent living activity hubs is defined in this standard.

Keywords: IEEE 11073-10471™, independent living activity hub, medical device communication, personal health devices

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[1] Available at: https://development.standards.ieee.org/myproject-web/public/view.html#landing.
[2] Available at: https://standards.ieee.org/content/ieee-standards/en/about/contact/index.html.

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[3] Available at: https://ieeexplore.ieee.org/browse/standards/collection/ieee.
[4] Available at: https://standards.ieee.org/standard/index.html.
[5] Available at: https://standards.ieee.org/about/sasb/patcom/materials.html.

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Introduction

This introduction is not part of IEEE Std 11073-10471-2023, IEEE Standard for Health informatics—Device Interoperability—Part 10471: Personal health device communication—Device specialization—Independent living activity hub.

ISO/IEEE 11073 standards enable communication between medical devices and external computer systems. This document uses the optimized framework created in ISO/IEEE 11073:20601 and describes a specific, interoperable communication approach for the Independent Living Activity Hub of personal health devices. These standards align with and draw on the existing clinically focused standards to provide support for communication of data from clinical or personal health devices (PHDs).

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Health Informatics—Device Interoperability—Part 10471: Personal Health Device Communication—Device Specialization—Independent Living Activity Hub

1. Overview

1.1 Scope

Within the context of the ISO/IEEE 11073 family of standards for device communication, this standard establishes a normative definition of the communication between independent living activity hubs and managers (e.g., cell phones, personal computers, personal health appliances, and set top boxes) in a manner that enables plug-and-play interoperability. It leverages appropriate portions of existing standards, including ISO/IEEE 11073 terminology and information models. It specifies the use of specific term codes, formats, and behaviors in telehealth environments restricting ambiguity in base frameworks in favor of interoperability. This standard defines a common core of communication functionality for independent living activity hubs. In this context, independent living activity hubs are defined as devices that communicate with simple situation monitors (binary sensors), normalize information received from the simple environmental monitors, and provide this normalized information to one or more managers. This information can be examined, for example, to determine when a person's activities/behaviors have deviated significantly from what is normal for them such that relevant parties can be notified. Independent living activity hubs will normalize information from the following simple situation monitors (binary sensors) for the initial release of the proposed standard: fall sensor, motion sensor, door sensor, bed/chair occupancy sensor, light switch sensor, smoke sensor, (ambient) temperature threshold sensor, personal emergency response system (PERS), and enuresis sensor (bed-wetting).

1.2 Purpose

This standard addresses a need for an openly defined, independent standard for controlling information exchange to and from personal health devices and managers (e.g., cell phones, personal computers, personal health appliances, and set top boxes). Interoperability is the key to growing the potential market for these devices and to enabling people to be better informed participants in the management of their health.

1.3 Word usage

The word *shall* indicates mandatory requirements strictly to be followed in order to conform to the standard and from which no deviation is permitted (*shall* equals *is required to*).[6,7]

The word *should* indicates that among several possibilities one is recommended as particularly suitable, without mentioning or excluding others; or that a certain course of action is preferred but not necessarily required (*should* equals *is recommended that*).

The word *may* is used to indicate a course of action permissible within the limits of the standard (*may* equals *is permitted to*).

The word *can* is used for statements of possibility and capability, whether material, physical, or causal (*can* equals *is able to*).

1.4 Context

See IEEE Std 11073-20601™ for an overview of the environment within which this standard is written.[8]

[6] The use of the word *must* is deprecated and cannot be used when stating mandatory requirements; *must* is used only to describe unavoidable situations.
[7] The use of *will* is deprecated and cannot be used when stating mandatory requirements; *will* is only used in statements of fact.
[8] Information on references can be found in Clause 2.

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This document, IEEE Std 11073-10471™, defines the device specialization for the independent living activity hub, being a specific agent type, and provides a description of the device concepts, its capabilities, and its implementation according to this standard.

This standard is based on IEEE Std 11073-20601, which in turn draws information from both IEEE Std 11073-10201™ [B5] and ISO/IEEE 11073:20101 [B9].[9] The medical device encoding rules (MDERs) used within this standard are fully described in IEEE Std 11073-20601.

This standard reproduces relevant portions of the nomenclature found in ISO/IEEE 11073:10101 [B8] and adds new nomenclature codes for the purposes of this standard. Between this standard and IEEE Std 11073-20601, all required nomenclature codes for implementation are documented.

The object classes and attributes in this standard are identified by nomenclature codes. Each code consists of a reference identifier (RefID) string and an integer code value. By using a consistent nomenclature, interoperability is enhanced as all implementations maintain the same semantic meaning for the numeric codes. This standard leverages the existing nomenclature codes in ISO/IEEE 11073:10101.

This standard defines specialized nomenclature codes that will be collected in IEEE Std 11073-10101™. Between this standard, IEEE Std 11073-10101, IEEE Std 11073-20601, and other IEEE Std 11073-104xx, all required nomenclature codes for implementation are documented. New codes may be defined in newer versions/revisions of each of these documents. In the case of a conflict, where one term code has been assigned to two separate semantic concepts with different RefIDs, in general the oldest definition that is in actual use should take precedence. The same policy applies when one RefID has two different code values assigned in different specifications. The resolution of such conflicts will be determined through joint action by the responsible workgroups and other stakeholders and any corrective action published as corrigenda.

NOTE—In this standard, IEEE Std 11073-104zz is used to refer to the collection of device specialization standards that utilize IEEE Std 11073-20601, where zz can be any number from 01 to 99, inclusive.[10]

2. Normative references

The following referenced documents are indispensable for the application of this document (i.e., they must be understood and used, so that each referenced document is cited in text and its relationship to this document is explained). For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments or corrigenda) applies.

IEEE Std 11073-20601™-2019, Health informatics—Personal health device communication—Part 20601: Application profile—Optimized Exchange Protocol.[11,12]

ISO/IEEE 11073:10101-2020, Health informatics—Point-of-care medical device communication—Part 10101: Nomenclature.[13]

See Annex A for all informative material referenced by this standard.

3. Definitions, acronyms, and abbreviations

For the purposes of this standard, the following terms and definitions apply. *The IEEE Standard Dictionary Online* **Error! Reference source not found.** should be referenced for terms not defined in this clause.

3.1 Definitions

agent: A node that collects and transmits personal health data to an associated manager.

[9] The numbers in brackets correspond to those of the bibliography in Annex A.
[10] Notes in text, tables, and figures are given for information only and do not contain requirements needed to implement the standard.
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class: In object-oriented modeling, it describes the attributes, methods, and events that objects instantiated from the class utilize.

compute engine: *See:* **manager**.

device: A term used to refer to a physical apparatus implementing either an agent or a manager role.

handle: An unsigned 16-bit number that is locally unique and identifies one of the object instances within an agent.

manager: A node receiving data from one or more agent systems. Some examples of managers include a cellular phone, health appliance, set top box, or a computer system.

obj-handle: *See*: **handle**.

object: In object-oriented modeling, a particular instantiation of a class. The instantiation realizes attributes, methods, and events from the class.

personal health device: A device used in personal health applications.

personal telehealth device: *See*: **personal health device**.

sensor: An apparatus that measures physical properties. These comprise the primary inputs to an independent living activity hub agent.

3.2 Acronyms and abbreviations

APDU	application protocol data unit
ASN.1	Abstract Syntax Notation One
DIM	domain information model
EUI-64	extended unique identifier (64 bits)
ICS	implementation conformance statement
MDC	medical device communication
MDER	medical device encoding rules
MDS	medical device system
MOC	managed object class
OID	object identifier
PDU	protocol data unit
PERS	personal emergency response system
PHD	personal health device
PIR	Passive Infrared
RT-SA	real-time sample array
VMO	virtual medical object
VMS	virtual medical system

4. Introduction to ISO/IEEE 11073 personal health devices

4.1 General

This standard and the remainder of the series of ISO/IEEE 11073 personal health device (PHD) standards fit in the larger context of the ISO/IEEE 11073 series of standards. The full suite of standards enables agents to interconnect and interoperate with managers and with computerized health-care information systems. See IEEE Std 11073-20601 for a description of the guiding principles for this series of ISO/IEEE 11073 personal health device standards.

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IEEE Std 11073-20601 supports the modeling and implementation of an extensive set of personal health devices. This standard defines aspects of the independent living activity hub device. It describes all aspects necessary to implement the application layer services and data exchange protocol between an ISO/IEEE 11073 PHD independent living activity hub agent and a manager. This standard defines a subset of the objects and functionality contained in IEEE Std 11073-20601 and extends and adds definitions where appropriate. All new definitions are given in Annex B in abstract syntax notation one (ASN.1) **Error! Reference source not found.**. All nomenclature codes referenced in this standard are collected in Annex C.

4.2 Introduction to IEEE Std 11073-20601 modeling constructs

4.2.1 General

The ISO/IEEE 11073 series of standards, and in particular IEEE Std 11073-20601, is based on an object-oriented systems management paradigm. The overall system model is divided into three principal components: the domain information model (DIM), the service model, and the communication model. See IEEE Std 11073-20601 for a detailed description of the modeling constructs.

4.2.2 Domain information model (DIM)

The DIM is a hierarchical model that describes an agent as a set of objects. These objects and their attributes represent the elements that control behavior and report on the status of the agent and data that an agent can communicate to a manager. Communication between the agent and the manager is defined by the application protocol in IEEE Std 11073-20601.

4.2.3 Service model

The service model defines the conceptual mechanisms for the data exchange services. Such services are mapped to messages that are exchanged between the agent and the manager. Protocol messages within the ISO/IEEE 11073 series of standards are defined in ASN.1. The messages defined in IEEE Std 11073-20601 can coexist with messages defined in other standard application profiles defined in the ISO/IEEE 11073 series of standards.

4.2.4 Communication model

In general, the communication model supports the topology of one or more agents communicating over logical point-to-point connections to a single manager. For each logical point-to-point connection, the dynamic system behavior is defined by a connection state machine, as specified in IEEE Std 11073-20601.

4.2.5 Implementing the models

An agent implementing this standard shall implement all mandatory elements of the information, service, and communication models as well as all conditional elements where the condition is met. The agent should implement the recommended elements, and it may implement any combination of the optional elements. A manager implementing this standard shall utilize at least one of the mandatory, conditional, recommended, or optional elements. In this context, “utilize” means to use the element as part of the primary function of the manager device. For example, a manager whose primary function is to display data would need to display a piece of data in the element in order to utilize it.

4.3 Compliance with other standards

Devices that comply with this standard may also be required to comply with other domain-and device specific standards that supersede the requirements of this standard with respect to issues including safety, reliability, and risk management. A user of this standard is expected to be familiar with all other such standards that apply and to comply with any higher specifications thus imposed.

Typically, medical devices should comply with the IEC 60601-1:2005 [B1] base standards with respect to electrical and mechanical safety as well as any device-specific standard as might be defined in the IEC 60601-2 [B2] series of standards. Software aspects may apply through standards such as IEC 62304:2006/EN 62304:2006 [B3]. Devices that comply with this standard implement higher layers of network software and utilize lower layers as appropriate to the application. The requirements on performance of such applications and conformance are defined elsewhere and are outside the scope of this standard. Moreover, the use of any medical equipment is subject to risk assessment and risk management appropriate to the

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application. Some relevant examples are ISO 14971:2007 [B7] and IEC 80001-1:2010 [B4]. The requirements of such risk assessment and risk management and conformance are outside the scope of this standard. The applicable versions of the referenced safety related standards may differ per country.

5. Independent living activity hub device concepts and modalities

5.1 General

This clause presents the general concepts of independent living activity hub devices. In the context of personal health devices in this family of standards, an independent living activity hub is a device that aggregates activity data sensor events from multiple sensor data sources, all of which are used in the support of the independent living of one or more occupants. The occupants' environment may vary greatly and encompass a varying mixture of sensors; therefore, the activity data sensor events reported by any particular agent have a corresponding variance.

5.2 Concepts

While many data generating sensors exist, they have a number of properties in common that influence the design of this standard. Note that these are only generalities employed in the design and there may be instances where an activity data generating sensor exceeds the following properties:

— Price: usually, they are inexpensive sensors.

— Power: typically, they are low power sensors.

— Communication: typically, they use an inexpensive communication technique and are quite often wireless.

— Frequency: typically, they communicate infrequently or only when an event occurs.

— Quantity: there may be a wide range of sensors and many instances of any one sensor type.

It is the responsibility of the independent living activity hub agent to manage all these sensors. Management of the sensors is likely to be within the proprietary purview of the agent both because there is no acceptable existing industry standard, and the desire to integrate existing legacy solutions with the IEEE 11073-20601 framework. Therefore, this responsibility is outside the scope of this standard. Only the communication between the independent living activity hub agent and the manager is covered by this standard.

Additionally, due to the many different types of sensors that may be employed in any particular installation, there is a range of functionality that the corresponding independent living activity hub agent presents to the manager. On the one hand, a fully functional independent living activity hub agent could represent a significant number of sensors and have a complex conversation with the associated manager. On the other hand, a subset of this protocol could be employed by just one sensor such that it would appear to a manager as an independent living activity hub agent with a single sensor.

Figure 1 shows a typical scenario with the type of sensors that might be fitted within a domicile of a person being monitored for their activities of daily living (ADL) and to ensure their safety. Sensors to determine activity and location within the room include passive infrared (PIR) motion, chair and sofa occupancy sensors, and a position sensor worn on the person to provide accurate tracking within the room. Sensors detect when appliances such as the table lamp and television are used. Sensors for safety include a smoke detector and temperature sensor, and a window sensor detects any unexpected opening that might indicate unauthorized entry. Sensors on the door can be used to determine exit and entry and warn of wander. The person also wears a sensor that can detect if they have fallen, and includes a button they can press (PERS) to summon assistance.

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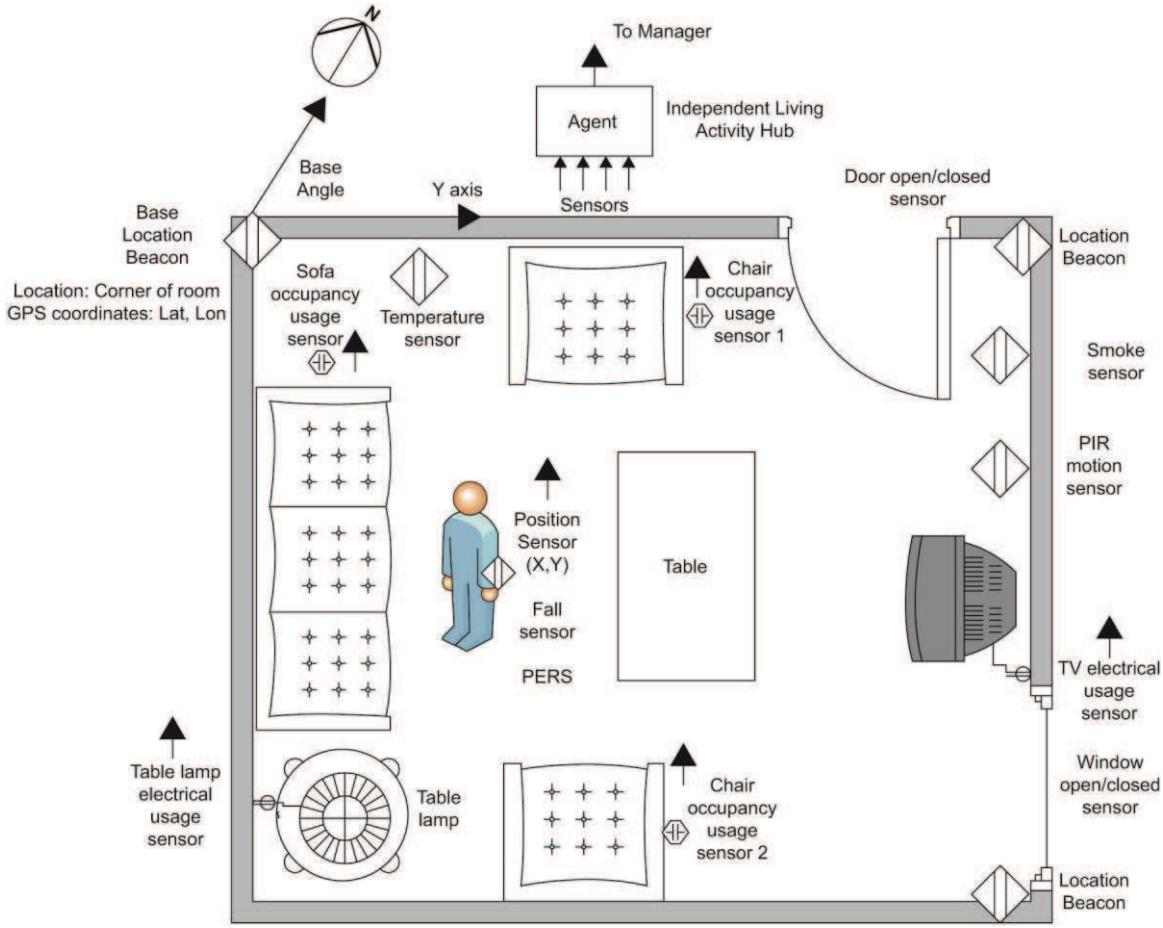


Figure 1—Independent living activity hub—typical scenario

In this scenario, sensors, such as PIR motion, temperature, and smoke are wired back to a common independent living activity hub (or use proprietary legacy wireless connection) that monitors each of the sensors and acts as a proxy to send their data and report their status to the manager. Other sensors, such as occupancy and usage, act as independent living activity hub agents that send their data and report their status direct to the manager.

Position is based on a radio beacon system. The corner of the room is used as the origin for the coordinates, and the beacon at this location is designated as the datum base. The location of the base beacon may be reported as the exact geographic location, as a meaningful descriptive location, or no location, as appropriate for an application. The orientation of the room (base angle) may be reported as the angle between geographic north and the Y axis of the coordinate system.

5.3 Collected data

5.3.1 General

This clause provides an overview of the kinds of sensors and activity data that could be collected. This is not to imply that all independent living activity hub agents would necessarily report values for all of these sensors. Furthermore, this standard is not concerned with the form of the data nor the communication between any actual sensor and the independent living activity hub; rather, only the activity data sensor events derived as a result of that data are considered part of this standard. See Clause 6 for the normative definition of this derived data.

5.3.2 Fall sensor

This sensor is used to notify the monitoring system that a fall sensor event has taken place. This could take the form of a sensor of the type that detects a person's fall and automatically generates the event. A pre-fall event can be sent if the sensor detects a stumble.

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5.3.3 PERS sensor

The personal emergency response system (PERS) sensor is used to notify the monitoring system that a personal emergency sensor event has taken place. This would typically take the form of a button that the person presses to indicate some sort of perceived emergency (“panic button”).

5.3.4 Environmental alert sensors

These sensors generate a sensor event whenever they sense an environmental aspect that is beyond a preset threshold. Examples include smoke sensors, carbon monoxide sensors, water sensors, and natural gas/liquid propane (LP) gas sensors.

5.3.5 Motion sensor

This sensor generates a sensor event whenever it has sensed movement within its range above a preset level. This type of sensor is typically employed in two manners: general motion and intruder detection.

In the case of general motion, the detection of the motion causes an immediate generation of a sensor event and subsequent action. This may be used for tracking the activity level of the occupant to discern whether behavior patterns have altered.

In the case of intruder detection, the motion sensor event could be used to trigger intruder detection actions.

Optionally, in the case of the primary entrances to the building; for example, the subsequent action to the sensor event may be delayed for some period before taken. This is to allow for an authorized person to enter the premises and to disable the sensor event before the action is taken (e.g., in the case where a triggered sensor event will generate an intruder alert). Should the proper disabling not take place within the expected delay time period, the normal subsequent action would take place. There may also be a sensor event for the case when the motion sensor detects someone attempting to tamper with its function.

5.3.6 Property exit sensor

This sensor generates a sensor event whenever it has sensed the exit of an occupant from the premises. This is commonly employed when there is an occupant with some cognitive issues who would encounter difficulties in an unfamiliar environment. There may also be a sensor event for the case where the premises’ exit is left open.

5.3.7 Enuresis sensor

This sensor generates a sensor event when it detects occurrences of involuntary urination or bed-wetting. This sensor could be utilized in a range of settings such as a bed, chair, or any similar structure.

5.3.8 Contact closure sensor

This sensor issues a sensor event whenever a contact is opened or closed. This sensor reports the state of the contact after a transition, either from closed to open or from open to closed. Only a single sensor event is sent for each transition. Examples of where this sensor would be deployed are passageway doors, cupboard doors, drawers, windows, and pressure mats.

5.3.9 Usage sensor

This sensor issues a sensor event to denote the start of use (into a bed/chair, for example) or the end of use (out of a bed/chair, for example). It also issues a sensor event for an anticipated usage not occurring by an expected preset time (expected use start violation) as well as a sensor event for the usage continuing beyond an expected preset time (expected use stop violation). Additionally, there would be a sensor event generated if during an expected usage time, the usage is discontinued for longer than a preset period of time (intermittent absence violation). An example would be that during a normal sleep period, a person got out of the bed and did not return in an expected period of time.

5.3.10 Switch use sensor

This sensor issues a sensor event for a switch changing states either to the used state (ON) or to the unused state (OFF). Examples of this are light switches, fan switches, and other similar switches that control electrical apparatus.

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5.3.11 Simple medication dispenser

The dispenser is a container that contains doses of one or more medications. The medications are to be taken in predetermined doses at predetermined times. A sensor event is generated for a presented dosage being taken from the dispenser (dosage taken) and/or for a dose not being taken after a predetermined amount of time (dosage missed). An event is generated when the dispenser becomes empty of medication and requires to be refilled.

NOTE—The sensor description presented here is of a conceptual model to aid in understanding. Be aware that the same derived sensor events could be generated through many other means (such as a user interaction with some screen interface), and devices may not be able to generate all of these events. This standard is only concerned with the generated sensor events.

5.3.12 Temperature alert sensor

This sensor monitors the temperature in an environment. It issues sensor events based on the sensor value being outside of a preset temperature limit. The sensor events could be that the ambient temperature has risen above a certain level (high threshold) or dropped below a certain level (low threshold), or that the rate-of-change is faster than a predetermined expected rate (rate-of-change). This can be used for detecting conditions such as the temperature of a dwelling being dangerously high/low, or that stove elements have been left on after cooking has been completed.

5.3.13 Relative humidity alert sensor

This sensor monitors the relative humidity in an environment. It issues sensor events based on the sensor value being outside of a preset humidity limit. The sensor events could be that the ambient relative humidity has risen above a certain level (high threshold). This can be used for detecting conditions such as the dangerously high humidity of a dwelling.

5.3.14 Ambient temperature sensor

This sensor monitors the temperature in an environment and reports the current temperature if capable, or the most recent temperature reading when the manager initiates a data request.

5.3.15 Ambient relative humidity sensor

This sensor monitors the humidity in an environment and reports the current relative humidity if capable, or the most recent relative humidity reading when the manager initiates a data request.

5.3.16 Ambient pressure sensor

This sensor monitors the pressure in an environment and reports the current pressure if capable, or the most recent pressure reading when the manager initiates a data request.

5.3.17 Pollen sensor

This sensor monitors the level of pollen in an environment and reports the level if capable, or the most recent pollen level reading when the manager initiates a data request. The pollen sensor may send readings when the level is elevated.

5.3.18 Dust particle sensor

This sensor monitors the level of dust particles in an environment and reports the current dust count if capable or the most recent dust particle count when the manager initiates a data request. The dust particle sensor may send readings when the level is elevated.

5.3.19 Utility accumulated usage sensor

This sensor reports on the total accumulated usage of a utility such electricity, gas, or water.

5.3.20 Wind speed

Wind speed is reported sepately as velocity and direction.

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5.3.20.1 Wind velocity

This sensor reports on velocity of the wind.

5.3.20.2 Wind direction

This sensor reports on the direction from which the wind is blowing. Expressed in degrees, 0 degrees indicates the wind is from due north.

5.3.21 Utility accumulated usage

These sensors report on the accumulated usage of a utility, including electricity, gas, and water for the household or individual appliance.

5.3.21.1 Electricity accumulated usage sensor

This sensor reports the total accumulated usage of electricity and reports the current accumulated reading if capable or the most recent accumulated reading when the manager initiates a data request. Usage over a period of time is determined by taking successive readings. This sensor could also report readings at predefined intervals.

5.3.21.2 Gas accumulated usage sensor

This sensor reports the total accumulated usage of gas and reports the most reports the current accumulated reading if capable or the most recent accumulated reading when the manager initiates a data request. Usage over a period of time is determined by taking successive readings. This sensor could also report readings at predefined intervals.

5.3.21.3 Water accumulated usage sensor

This sensor reports the total accumulated usage of water and reports the current accumulated reading if capable or the most recent accumulated reading when the manager initiates a data request. Usage over a period of time is determined by taking successive readings. This sensor could also report readings at predefined intervals.

5.3.22 Utility instantaneous usage sensor

These sensors report on the instantaneous usage of a utility, including electricity, gas, and water for the household or individual appliance.

5.3.22.1 Electricity instantaneous usage sensor

This sensor reports the instantaneous usage of electricity and reports the current reading if capable, or the most recent reading when the manager initiates a data request. This sensor could also report readings at predefined intervals or based on predefined trigger events such as usage.

5.3.22.2 Gas instantaneous usage sensor

This sensor reports the instantaneous usage of gas and reports the current reading if capable, or the most recent reading when the manager initiates a data request. This sensor could also report readings at predefined intervals or based on predefined trigger events such as usage.

5.3.22.3 Water instantaneous usage sensor

This sensor reports the instantaneous usage of water and reports the current reading if capable, or the most recent reading when the manager initiates a data request. This sensor could also report readings at predefined intervals or based on predefined trigger events such as usage.

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5.3.23 Solar accumulated generation sensor

This sensor reports on the total accumulated generation of energy by photovoltaic cells installed in a location and reports the current accumulated generation reading if capable, or the most recent accumulated reading when the manager initiates a data request. Usage over a period of time is determined by taking successive readings. This sensor could also report readings at predefined intervals.

5.3.24 Solar instantaneous generation sensor

This sensor reports on the instantaneous generation of energy by photovoltaic cells installed in a location and reports the current reading if capable, or the most recent reading when the manager initiates a data request. This sensor could also report readings at predefined intervals or based on predefined trigger events such as usage.

5.3.25 Location

This sensor reports its current location as an enumeration of one of the location codes and can indicate if the sensor is at or not at the location. The sensor may also emit a string that provides a descriptive annotation of the location such as a human readable string or might report the identity of a beacon in a location system.

5.3.26 Relative location coordinates

Location within a defined space, such as a room, building, or site are reported as the Cartesian coordinates {X, Y, Z} relative to a datum base coordinate (origin) or specified identified datum base location. If the datum base coordinate is specified, then geographic coordinates are used as the datum base X (latitude), Y (longitude), and Z (altitude) coordinates, together with the angle of the Y axis of the local coordinate space relative to geographic coordinates (±180°). Alternatively, the datum base coordinate may be specified as a well-defined location within the defined space together with the angle of the Y axis of the local coordinate space relative to geographic coordinates. The location may be specified as one of the location codes and/or a string to describe the location.

If a datum base coordinate or the angle is not specified, then the relative coordinates are interpreted as appropriate for the location system within the defined space, such as a space defined by a wireless location system.

5.3.26.1 Relative Location coordinates

This sensor reports the {X, Y, Z} coordinates of the relative location of a device within a defined space.

5.3.26.2 Base coordinate

This metric object reports the geographic coordinates (latitude, longitude, and altitude) for the datum base coordinate (origin) of the defined space. The location is reported by two metric objects: longitude and latitude, and altitude.

5.3.26.3 Base angle

This metric object reports the angle of the Y axis of the local coordinate space relative to geographic coordinates.

5.3.26.4 Base coordinate location

This metric object reports the datum base coordinate (origin) of the defined space as a well-defined physical location. The location may be specified as one of the location codes and/or a string to describe the location.

5.3.27 GPS location coordinates

This sensor reports the location of the device as the GPS (geographic) coordinates of longitude, latitude, and altitude. In many cases only longitude and latitude are reported, and for this reason GPS location is reported by two metric objects: longitude and latitude, and altitude.

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5.3.28 Speed and heading

These sensors report separately the speed and heading of the device.

5.3.28.1 Speed

This sensor reports the absolute speed of the device.

5.3.28.2 Heading

This sensor reports the heading relative to geographic coordinates

5.3.29 Identity

This object reports an opaque string that is a used as a locally unique identifier of the person or object associated with other sensors in an independent living activity hub agent. This could include such information as identification from an RFID tag, or patient identity number. If the identity object is present, then those sensors associated with a person shall have the Source-Handle-Reference set to the value of the handle of the identity object.

5.3.30 Encounter

This object reports an opaque string that is a used to provide a locally unique identifier of the person or object that has been encountered by this agent. This could include such information as identification from RFID tag, BlueTooth MAC address, or patient identity number. The form of encounter is not specified and could take the form of detection of being in close proximity.

5.4 Reporting data from multiple persons

5.4.1 Identification of a single person

IEEE 11073 contains several mechanisms that permit a device or observation to be associated with a specific person or object. The medical device system (MDS) of every IEEE 11073 device includes a unique extended unique identifier (64 bits) (EUI-64) that may be used to associate a specific device with a single user, and thereby associate all observations from that device with that patient or object.

5.4.2 Identification of multiple persons using multiple person dynamic data update

Where a single device is used to report observations from multiple persons, the multiple person form of the dynamic data update (6.5.3) may be used to report the observations of each individual. A person number is allocated to each individual and observations with that person number as header in the multiple persons dynamic data update are associated with that person. This approach has the disadvantage that the association of a sensor with a person is unknown until an observation is reported and the association of a sensor may be to multiple persons. There is a further disadvantage that the person number must be mapped a-priroi to each specific person for whom observations will be reported.

5.4.3 Identification of multiple persons using the identity object

The independent living activity hub may act as proxy for a sensor that is used by people who have previously not been configured in the sensor. This may be the case for entry systems where a card reader is used to identify the individual when they present a card to gain entry to a building. Information regarding which observation is associated with which person is provided by using the identity object. An identity object is instantiated and used to report the locally unique identification as an observation. If the Source-Handle-Reference attribute of a sensor object references the identity object, then the locally unique identity of a person can be associated to an observation from the sensor.

Figure 2 shows how an enumeration object references an associated identity object.

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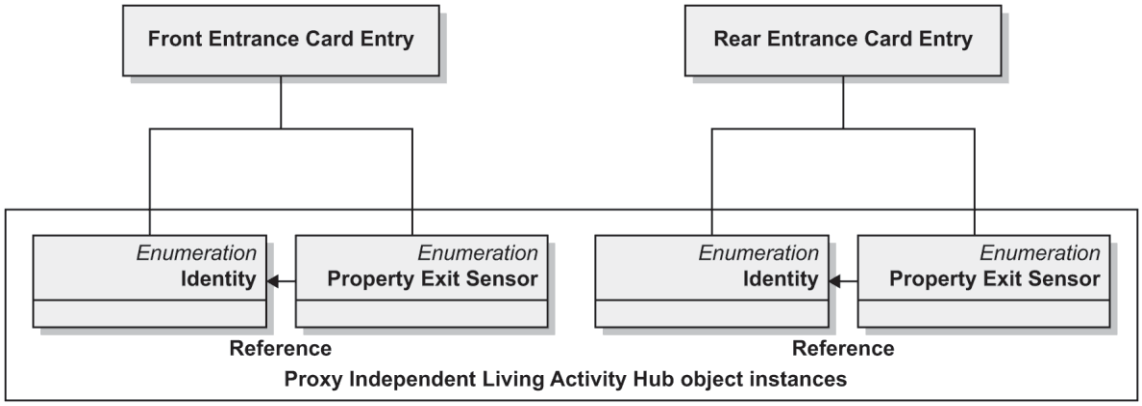


Figure 2—Identification of multiple persons using the identity object

Figure 3 provides an example of the use of the identity object to provide the identify of a person entering though the front door of a property and later leaving by the back door. An enumeration object references the associated identify object by using the value of handle of the identity object in the source reference handle field. The time stamp fields shall have the same value.

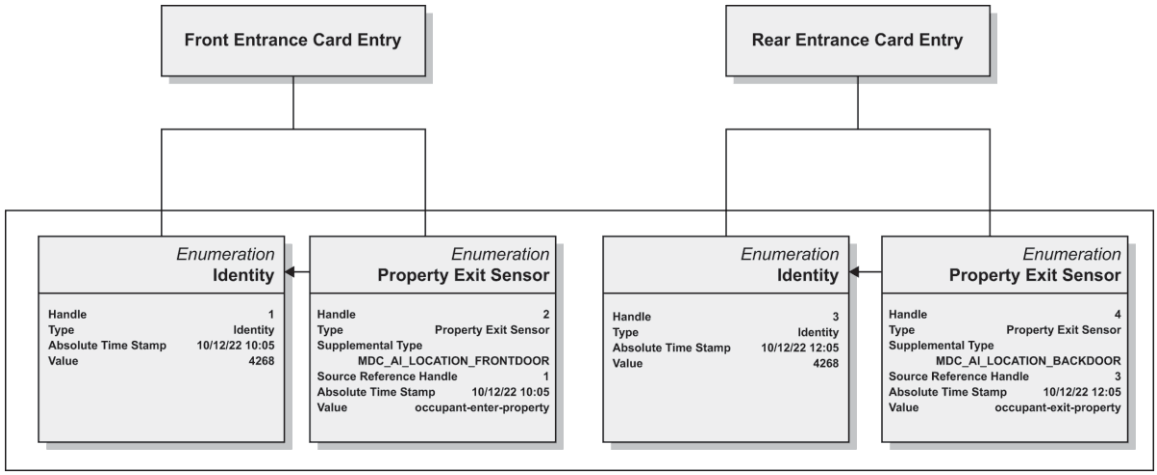


Figure 3—Example use of the identity object

6. Independent living activity hub domain information model

6.1 Overview

This clause describes the domain information model of the independent living activity hub.

6.2 Class extensions

In this standard, no class extensions are defined with respect to IEEE Std 11073-20601.

6.3 Object instance diagram

The object instance diagram of the independent living activity hub domain information model, defined for the purposes of this standard, is shown as Figure 4 and Figure 5.

The generic DIM of the independent living activity hub that is presented in Figure 4 and Figure 5 defines all possible data objects. However, it would be expected that most independent living activity hubs would implement only a restricted subset of the data objects. An independent living activity hub shall implement at least one sensor instance.

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The objects of the DIM, as shown in Figure 4 and Figure 5, are described in 6.4 to 6.12. This includes the medical device system (MDS) object (see 6.5), the numeric objects (see 6.6), the real-time sample array (RT-SA) objects (see 6.7), the enumeration objects (see 6.8), the PM-store objects (see 6.9), and the scanner objects (see 6.10). See 6.12 for rules for extending the independent living activity hub information model beyond elements as described in this standard. Each clause that describes an object of the independent living activity hub contains the following information:

— The nomenclature code used to identify the class of the object. One example of where this code is used is the configuration event, where the object class is reported for each object. This allows the manager to determine whether the class of the object being specified is a numeric, real-time sample array, enumeration, scanner, or PM-store class.

— The attributes of the object. Each object has attributes that represent and convey information on the activity data generating sensor and its data sources. Each object has a Handle attribute that identifies the object instance within an agent. Attribute values are accessed and modified using communication services such as GET and SET. Attribute types are defined using ASN.1. The ASN.1 definitions for new attribute types specific to this standard are in Annex B, and the ASN.1 definitions for existing attribute types referenced in this standard are in IEEE Std 11073-20601.

— The methods available on the object.

— The potential events generated by the object. Data are sent to the manager using events.

— The available services such as getting or setting attributes.

The attributes for each class are defined in tables that specify the name of the attribute, its value, and its qualifier. The qualifiers mean M—Attribute is Mandatory, C—Attribute is Conditional and depends on the condition stated in the Remark or Value column (if IEEE Std 11073-20601 is referenced, then it contains the conditions), R—Attribute is Recommended, NR—Attribute is Not Recommended, and O—Attribute is Optional. Mandatory attributes shall be implemented by the agent. Conditional attributes shall be implemented if the condition applies and may be implemented otherwise. Recommended attributes should be implemented by the agent. Not recommended attributes should not be implemented by the agent. Optional attributes may be implemented by the agent. For attributes with qualifiers set to R or NR, underlying requirements stated in the Remark and Value column in IEEE Std 11073-20601 shall be followed. If any attribute (from the DIM of IEEE Std 11073-20601) is not included in the definition of that object in this standard, it shall not be included in that object by an implementation, unless it is a vendor-specific attribute extended according to 6.12.

An attribute is further qualified as static, dynamic, or observational. Static attributes shall not change value during the life of an association. Dynamic attributes have a value that may change during the life of an association. The dynamic attribute value should be sent at configuration time and shall be sent at or before the time when the value would be needed for interpreting a reported observation. Observational attributes have a value that may change during the life of an association. When a set of observational attribute values are received, these values are combined with the available context information (i.e., all related dynamic and static attribute values) to represent the observation at the observation time.

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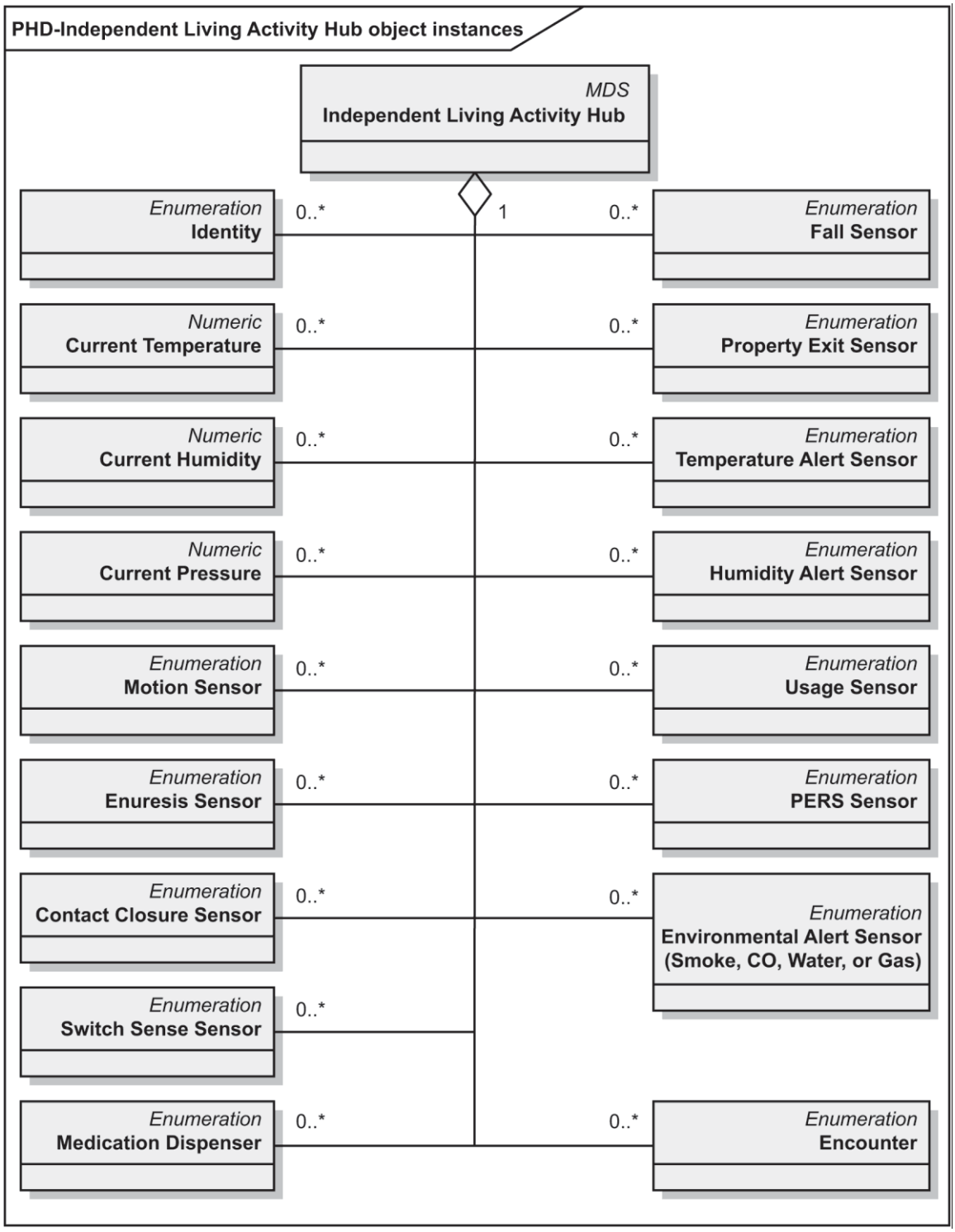


Figure 4—Independent living activity hub—object instances

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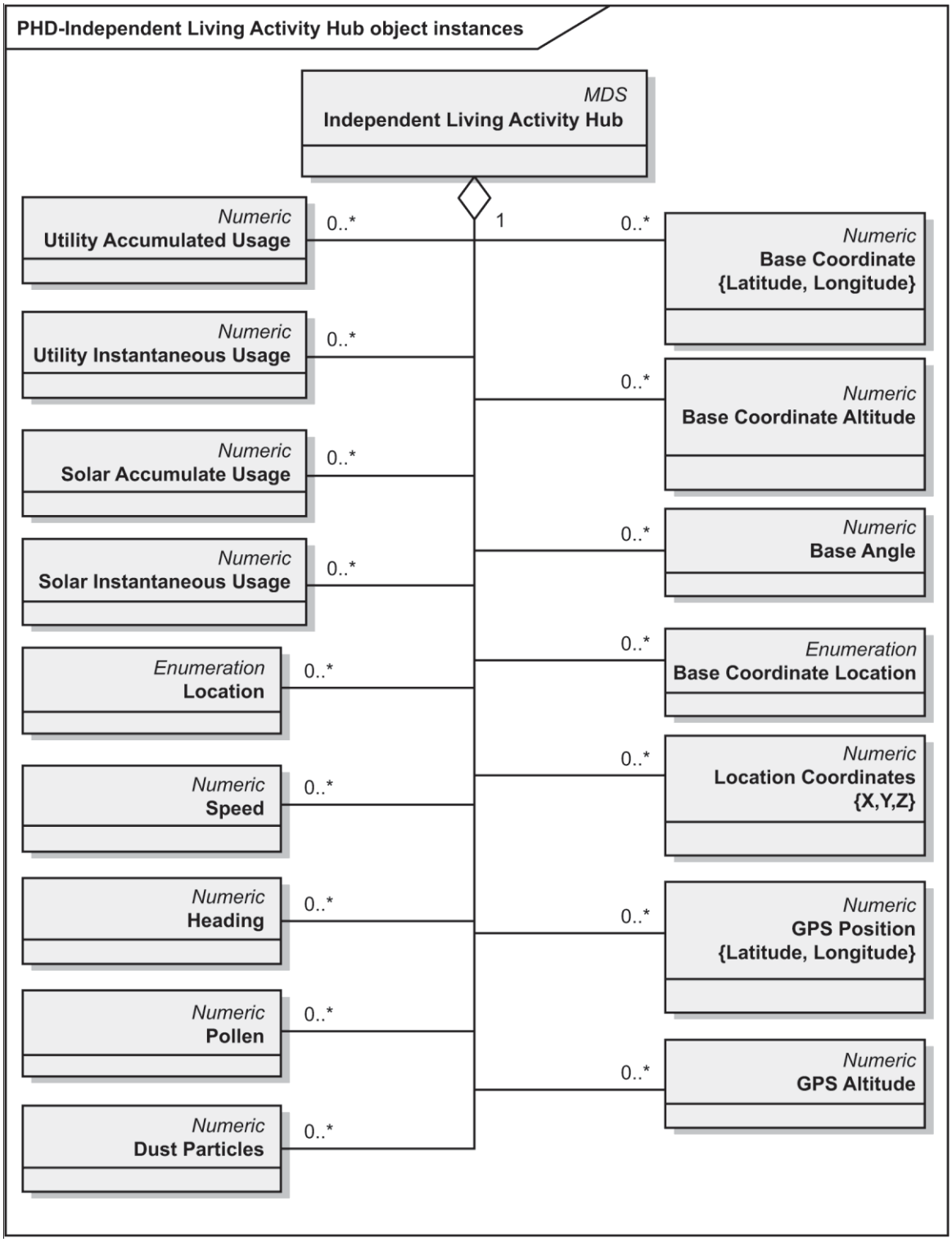


Figure 5—Independent living activity hub—object instances

6.4 Types of configuration

6.4.1 General

As specified in IEEE Std 11073-20601, there are two styles of configuration available. Subclauses 6.4.2 and 6.4.3 briefly introduce standard and extended configurations.

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6.4.2 Standard configuration

This standard does not define any standard configurations since the set of sensors for each agent configuration is likely to vary significantly for each deployment scenario. Therefore, all configurations shall be specified as extended configurations.

6.4.3 Extended configuration

In extended configurations, the agent's configuration is not predefined in a standard. The agent determines which objects, attributes, and values that it wants to use in a configuration and assigns a configuration identifier. When the agent associates with a manager, it negotiates an acceptable configuration. Typically, the manager does not recognize the agent's configuration on the first connection, so the manager responds that the agent must send its configuration information as a configuration event report. However, if the manager already understands the configuration, either because it was preloaded in some way or the agent had previously associated with the manager, then the manager responds that the configuration is known and no further configuration information needs to be sent.

6.5 Medical device system object

6.5.1 MDS object attributes

Table 1 summarizes the attributes of the independent living activity hub MDS object. The nomenclature code to identify the MDS class is MDC_MOC_VMS_MDS_SIMP.

Table 1—MDS object attributes

Attribute name	Value	Qual.
Handle	0	M
System-Type-Spec-List	{MDC_DEV_SPEC_PROFILE_AI_ACTIVITY_HUB,2}. If an agent follows a profile within this specialization this profile shall be specified in the System-Type-Spec-List.	M
System-Type	Attribute not present. See IEEE Std 11073-20601.	NR
System-Model	{"Manufacturer","Model"}.	M
System-Id	EUI-64.	M
Dev-Configuration-Id	Extended configs: 0x4000–0x7FFF.	M
Attribute-Value-Map	See IEEE Std 11073-20601.	C
Production-Specification	See IEEE Std 11073-20601.	O
Mds-Time-Info	See IEEE Std 11073-20601.	C
Date-and-Time	See IEEE Std 11073-20601.	C
Base-Offset-Time	See IEEE Std 11073-20601.	R
Relative-Time	See IEEE Std 11073-20601.	NR
HiRes-Relative-Time	See IEEE Std 11073-20601.	O
Date-and-Time-Adjustment	See IEEE Std 11073-20601.	C
Power-Status	*onBattery* or *onMains*.	R
Battery-Level	See IEEE Std 11073-20601.	R
Remaining-Battery-Time	See IEEE Std 11073-20601.	R
Reg-Cert-Data-List	See IEEE Std 11073-20601.	O
Confirm-Timeout	See IEEE Std 11073-20601.	O
Transport-Timeout	See IEEE Std 11073-20601.	O
NOTE—See IEEE Std 11073-20601 for information on whether an attribute is static, or dynamic.		

NOTE—See 6.3 for a description of the qualifiers.

In the response to a Get MDS object command, only implemented attributes and their corresponding values are returned.

See IEEE Std 11073-20601 for descriptive explanations of the individual attributes as well as for information on attribute ID and attribute type.

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The Dev-Configuration-Id attribute holds a locally unique 16-bit identifier that identifies the device configuration. For an independent living activity hub agent with extended configuration, this identifier is chosen in the range of extended-config-start to extended-config-end (see IEEE Std 11073-20601) as shown in Table 1.

The agent sends the Dev-Configuration-Id during the Associating state (see 8.3) to identify its configuration for the duration of the association. If the manager already holds the configuration information relating to the Dev-Configuration-Id, it recognizes the Dev-Configuration-Id. Then the Configuring state (see 8.4) is skipped; the agent and manager then enter the Operating state. If the manager does not recognize the Dev-Configuration-Id, the agent and manager enter the Configuring state.

If an agent implements multiple IEEE 11073-104zz specializations, System-Type-Spec-List is a list of type/version pairs, each referencing the respective device standard and version of that standard.

6.5.2 MDS object methods (actions)

Table 2 defines the methods (actions) of the MDS object. These methods are invoked using the Action service. In Table 2, the Subservice type name column defines the name of the method. The Mode column defines whether the method is invoked as an unconfirmed action (i.e., roiv-cmip-action from IEEE Std 11073-20601) or a confirmed action (i.e., roiv-cmip-confirmed-action). The Subservice type (action-type) column defines the nomenclature code used in the action-type field of an action request and response (see IEEE Std 11073-20601). The Parameters (action-info-args) column defines the associated ASN.1 data structure (see IEEE Std 11073-20601 for ASN.1 definitions) to use in the action message for the action-info-args field of the request. The Results (action-info-args) column defines the structure to use in the action-info-args of the response.

Table 2—MDS object methods (actions)

Service	Subservice type name	Mode	Subservice type (action-type)	Parameters (action-info-args)	Results (action-info-args)
ACTION	Set-Time	Confirmed	MDC_ACT_SET_TIME	SetTimeInvoke	—
	Set-Base-Offset-Time	Confirmed	MDC_ACT_SET_BO_TIME	SetBOTimeInvoke	—
	MDS-Data-Request	Confirmed	MDC_ACT_DATA_REQUEST	DataRequest	DataResponse

— **Set-Time:**
This method allows the manager to set a real-time clock in the agent with the absolute time. The agent indicates whether the Set-Time command is valid using the mds-time-capab-set-clock bit in the Mds-Time-Info attribute (see IEEE Std 11073-20601). Agents with an internal real-time clock shall indicate this capability by also setting the mds-time-capab-real-time-clock bit in the Mds-Time-Info attribute. The Set-Time method can only be supported if the Absolute-Time-Stamp attribute is supported.

— **Set-Base-Offset-Time:**
This method allows the manager to set a real-time clock in the agent with the base time and offset. The agent indicates whether the Set-Base-Offset-Time command is valid using the mds-time-capab-set-clock bit in the Mds-Time-Info attribute (see IEEE Std 11073-20601). The Set-Base-Offset-Time method can only be supported if the Base-Offset-Time-Stamp attribute is supported.

— **MDS-Data-Request:**
This method allows the manager system to request measurement data from an agent (see IEEE Std 11073-20601 for a description).

Agents following only this device specialization and no others shall send event reports (see 6.5.3) using agent-initiated measurement and/or manager-initiated measurement data transmission. Agents following this device specialization shall send event reports or request data in the appropriate fashion. During the association procedure (see 8.3), DataReqModeCapab shall be set to the appropriate value for the event report or data request style. As a result, the manager shall assume that if the

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independent living activity hub agent supports MDS-Data-Request, then it may access the object value only if the object's Metric-Spec-Small attribute has its mss-acc-manager-initiated bit set (see IEEE Std 11073-20601 for additional information).

6.5.3 MDS object events

Table 3 defines the events sent by the independent living activity hub MDS object:

Table 3—Independent living activity hub MDS object events

Service	Subservice type name	Mode	Subservice type (event-type)	Parameters (event-info)	Results (event-reply-info)
EVENT REPORT	MDS-Configuration-Event	Confirmed	MDC_NOTI_CONFIG	ConfigReport	ConfigReportRsp
	MDS-Dynamic-Data-Update-Var	Confirmed	MDC_NOTI_SCAN_REPORT_VAR	ScanReportInfoVar	—
	MDS-Dynamic-Data-Update-Fixed	Confirmed	MDC_NOTI_SCAN_REPORT_FIXED	ScanReportInfoFixed	—
	MDS-Dynamic-Data-Update-MP-Var	Confirmed	MDC_NOTI_SCAN_REPORT_MP_VAR	ScanReportInfoMPVar	—
	MDS-Dynamic-Data-Update-MP-Fixed	Confirmed	MDC_NOTI_SCAN_REPORT_MP_FIXED	ScanReportInfoMPFixed	—

— **MDS-Configuration-Event:**
This event is sent by the independent living activity hub agent during the configuring procedure if the manager does not already know the independent living activity hub agent's configuration from past associations or because the manager has not been implemented to recognize the configuration according to the independent living activity hub device standard. The event provides static information about the supported measurement capabilities of the independent living activity hub agent.

— **MDS-Dynamic-Data-Update-Var:**
This event provides dynamic measurement data from the independent living activity hub agent for the independent living activity data objects. These data are reported using a generic attribute list variable format. The event is sent as an unsolicited message by the agent (i.e., an agent-initiated measurement data transmission). See 8.5.3 for more information on unsolicited event reporting.

— **MDS-Dynamic-Data-Update-Fixed:**
This event provides dynamic measurement data from the independent living activity hub agent for the independent living activity data objects. These data are reported in the fixed format defined by the Attribute-Value-Map attribute of the object(s). The event is sent as an unsolicited message by the agent (i.e., an agent-initiated measurement data transmission). See 8.5.3 for more information on unsolicited event reporting.

— **MDS-Dynamic-Data-Update-MP-Var:**
This is the same as MDS-Dynamic-Data-Update-Var, but allows inclusion of data from multiple people.

— **MDS-Dynamic-Data-Update-MP-Fixed:**
This is the same as MDS-Dynamic-Data-Update-Fixed, but allows inclusion of data from multiple people.

NOTE—IEEE Std 11073-20601 requires that managers support all of the MDS object events listed above.

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6.5.4 Other MDS services

6.5.4.1 GET service

An independent living activity hub agent shall support the GET service to retrieve the values of all implemented attributes of the MDS object. The GET service can only be invoked after the manager has confirmed selection of the configuration of the Agent.

The GET request for all attributes shall be supported. An attribute-id-list parameter may be supported.

The manager may request the MDS object attributes of the independent living activity hub agent; in which case, the manager shall send the "Remote Operation Invoke | Get" message (see roiv-cmip-get in IEEE Std 11073-20601) with the reserved MDS handle value of 0. The independent living activity hub agent shall report its MDS object attributes to the manager using the "Remote Operation Response | Get" message (see rors-cmip-get in IEEE Std 11073-20601). See Table 4 for a summary of the GET service including some message fields.

Table 4—Independent living activity hub MDS object GET service

Service	Subservice type name	Mode	Subservice type	Parameters	Results
GET	<na>	<implied confirmed>	<na>	GetArgumentSimple=(obj-handle=0), attribute-id-list <*optional*>	GetResultSimple=(obj-handle=0), attribute-list

See 8.5.2 for details on the procedure for getting the MDS object attributes.

6.5.4.2 SET service

The independent living activity hub standard does not require an implementation to support the MDS object SET service.

6.6 Numeric objects

6.6.1 General

The independent living activity hub requires one numeric data object for each supported sensor instance. Objects instantiated from the numeric class are used to report the environmental data. The nomenclature code to identify the enumeration class is MDC_MOC_VMO_METRIC_NU. The attributes of a numeric data object are shown in Table 5. The attribute structure shown in Table 5 is common to all sensor types. Later clauses define the precise definitions for each sensor type.

Sometimes, the interpretation of one attribute value in an object depends on other attribute values in the same object. For example, Unit-Code and Unit-LabelString provide context for the observed values. Whenever a contextual attribute changes, the agent shall report these changes to the manager using an MDS object event (see 6.5.3) prior to reporting any of the dependent values.

Table 5—Activity data numeric object attributes

Attribute name	Extended configuration	
	Value	Qual.
Handle	See IEEE Std 11073-20601.	M
Type	Any of the MDC_PART_PHD_AI, MDC_AI_TYPE_* ID's. See Annex C.	M

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