



# Sensor Data Format

Version 1.0.1

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Scenera, Inc., Nikon Corporation, Sony Semiconductor Solutions Corporation, Wistron Corporation and Hon Hai Precision Industry Co., Ltd.(NICE Alliance Promoters) contributed to this document.

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## Contributors

Name	Company
Andrew Wajs	Scenera
Aviram Cohen	Scenera
Hideki Ando	Sony
Hironori Miyoshi	Sony
Wendy Tin	Wistron

## Table of Contents

<b>1. Introduction</b> .....	<b>5</b>
<b>2. Data Types</b> .....	<b>5</b>
2.1. <i>SenML Data</i> .....	5
2.1.1. Temperature .....	6
2.1.2. Humidity .....	6
2.1.3. Carbon Monoxide .....	6
2.1.4. IR detection.....	6
2.1.5. Pressure.....	6
2.1.6. Proximity .....	7
2.1.7. Liquid Level.....	7
2.1.8. Acceleration .....	7
2.1.9. Rotation.....	7
2.1.10. SenML Error Designator .....	8
2.2. <i>Geo Location Data</i> .....	8
2.2.1. Geo Location Information .....	8
2.2.2. Error Information .....	8
2.3. <i>Encryption and Authentication</i> .....	9
2.4. <i>JSON Schema</i> .....	9

## 1. Introduction

NICE Devices may generate many different types of data including temperature, humidity, geo-location etc. The purpose of this document is to define a common JSON structure that can be used to represent different types of IoT Data in a consistent manner.

This specification is based on the formats defined in RFC 8428 (Sensor Measurement Lists - SenML) and RFC 7946 (GeoJSON Format).

This document specifies how these standards should be used in the NICE context.

## 2. Data Types

The following types of data are supported using SenML data format defined in RFC 8428:

- Temperature
- Humidity
- Carbon Monoxide
- IR - infrared sensor - binary value of detected or not detected.
- Pressure
- Proximity - binary value of detected or not detected.
- Level
- Acceleration
- Rotation

The units for each type of data is defined in RFC 8428.

The following data shall be supported using RFC 7946:

- Geo Location - This is made up of components – Altitude, Longitude and Latitude.

### 2.1. SenML Data

RFC 8428 - Sensor Measurement Lists (SenML) defines a format for samples. A data sample is held as an element of a samples array. For purposes of NICE the data shall be represented in JSON format.

The following restrictions shall apply:

**Base Name:** The Device ID for the device that is generating the data.

**Name:** Identifies data type. Name is used to specify a component in multi-dimensional data, or to specify a cause of error in error designator.

**Base Time and Time:** Date/time when the data was sampled.

**Value:** Data content value as defined in subsections below, or one of error designator strings in Error Designator String section;

Base Unit and Unit may be used but shall not be interpreted. Units of data are defined in this specification. Any Base Units and/or Units in SenML Records shall be ignored.

Other fields may be used as per RFC 8428.

### 2.1.1. Temperature

Temperature data. Fields in SenML Records are as follows.

**Base Name:** DeviceID

**Name:** "Temperature"

**Value:** Temperature in degrees Celsius

### 2.1.2. Humidity

Relative humidity data. Fields in SenML Records are as follows.

**Base Name:** DeviceID

**Name:** "Humidity"

**Value:** Percentage of relative humidity (0 to 100 inclusive)

### 2.1.3. Carbon Monoxide

Carbon monoxide data. Fields in SenML Records are as follows.

**Base Name:** DeviceID

**Name:** "CarbonMonoxide"

**Value:** Percentage of carbon monoxide (0 to 100 inclusive)

### 2.1.4. IR detection

Infrared sensor detection data. Fields in SenML Records are as follows.

**Base Name:** DeviceID

**Name:** "IRDetection"

**Boolean Value:** 0 (undetected) or 1 (detected)

### 2.1.5. Pressure

Pressure data. Fields in SenML Records are as follows.

**Base Name:** DeviceID

**Name:** "Pressure"

**Value:** Pressure in Pascals

### 2.1.6. Proximity

Proximity detection data. Fields in SenML Records are as follows.

**Base Name:** DeviceID

**Name:** "Proximity"

**Boolean Value:** 0 (undetected) or 1 (detected)

### 2.1.7. Liquid Level

Liquid level (water level) data. Fields in SenML Records are as follows.

**Base Name:** DeviceID

**Name:** "LiquidLevel"

**Value:** Percentage of liquid storage level (0 to 100 inclusive)

### 2.1.8. Acceleration

Acceleration data, may have multiple dimensions. Fields in SenML Records are as follows.

**Base Name:** DeviceID

**Name:** "AccelerationX" for x-axis, "AccelerationY" for y-axis, "AccelerationZ" for z-axis.

**Value:** Linear acceleration in m/s<sup>2</sup>

### 2.1.9. Rotation

Rotational speed data, may have multiple dimensions. Fields in SenML Records are as follows.

**Base Name:** DeviceID

**Name:** "RotationX" for x-axis, "RotationY" for y-axis, "RotationZ" for z-axis.

**Value:** Angular velocity in rad/s

## 2.1.10. SenML Error Designator

This is used to show that an error has occurred in data acquisition or data processing. Fields in SenML Records are as follows.

**Base Name:** DeviceID

**Name:** "Error"

**String Value:** "Corrupted": Data corruption detected.

"Lost": Data lost detected.

"Unsupported": Not able to interpret data.

"Unknown": Unknown error occurred.

## 2.2. Geo Location Data

A data sample of geo location data consists of timestamp and location data, held as an element of Samples array in a format below.

Timestamp shows the date and time when the sample is acquired. The syntax of the data shall conform to NICE Date Time format.

The location data contains either a geo location information or an error information.

### 2.2.1. Geo Location Information

The data format of the geo location information shall conform to the format of Geometry object in Point type defined in RFC 7946 GeoJSON with following restrictions::

- "type" property value shall be "Point".
- "coordinates" property shall have at least two (2) and at most three (3) elements. Elements shall contain coordinate data in the order of longitude, latitude, and altitude if exists. Units are as defined in RFC 7946 and in the World Geodetic System (WGS 84).
- "bbox" property shall not be used.

### 2.2.2. Error Information

The format of the error information shall be the same as that of the geo location information with exceptions below.

"type" property value shall be either of the following:

- "Corrupted": Data corruption detected.
- "Lost": Data lost detected.
- "Unsupported": Not able to interpret data.
- "Unknown": Unknown error occurred.



Other properties shall not be used.

## 2.3. Encryption and Authentication

The JSON objects may be encrypted and authenticated using the methods defined in the NICE Privacy and Security Specification.

## 2.4. JSON Schema

The following is the JSON schema for the DataSample Object.

```
{
  "$schema": "http://json-schema.org/draft-06/schema#",
  "type": "object",
  "title": "SensorData",
  "description": "NICE Data Format for Series of Samples from an IoT Sensor
  Units:
    Temperature : degrees Celsius
    Humidity:     percent
    CarbonMonoxide: percent
    IRDetection:  0 (undetected) or 1 (detected)
    Pressure:     Pascal
    Proximity:    0 (undetected) or 1 (detected)
    LiquidLevel  : percent
    Acceleration : m/s^2
    Rotation:     rad/s
    GeoLocation: as per RFC 7946 / WGS 84",
  "properties": {
    "Version": {
      "type": "string",
      "enum": [
        "1.0"
      ]
    },
    "DataID": {
      "type": "string"
    },
    "TransducerID": {
      "type": "string"
    },
    "StartDateTime": {
      "type": "string",
      "description": "Start Time for the Sequence of Data within this object in NICE Date
Time format."
    },
    "EndDateTime": {
      "type": "string",
      "description": "End Time for the Sequence of Data within this object in NICE Date Time
format."
    },
    "Data": {
      "oneOf": [
        {
          "SenMLData": {
            "type": "object",
            "description": "Collection of SenML Record data.",
            "properties": {
              "Type": {
                "type": "string",
                "enum": [
                  "Temperature",
                  "Humidity",
                  "CarbonMonoxide",
                  "IRDetection",
                  "Pressure",

```

```

        "Proximity",
        "LiquidLevel",
        "Acceleration",
        "Rotation"
    ]
},
"Samples": {
    "type": "array",
    "items": {
        "type": "string",
        "description": "RFC 8428 SenML Record or error designator
string."
    }
}
},
"required": [
    "Type",
    "Samples"
]
}
},
{
    "GeoLocationData": {
        "type": "object",
        "description": "Geo location data.",
        "properties": {
            "Type ": {
                "type": "string",
                "enum": [
                    "GeoLocation"
                ]
            },
            "Samples": {
                "type": "array",
                "items": {
                    "type": "object",
                    "description": "Geo location data with timestamp.",
                    "properties": {
                        "DateTime": {
                            "type": "string",
                            "description": "Timestamp at when the location data is sampled in NICE Date Time format."
                        },
                        "oneOf": [
                            {
                                "Location": {
                                    "type": "object",
                                    "description": "RFC 7946 GeoJSON Geometry object in Point type.",
                                    "properties": {
                                        "type": {
                                            "type": "string",
                                            "enum": [
                                                "Point"
                                            ]
                                        },
                                        "coordinates": {
                                            "type": "array",

```

```

        "minItems": 2,
        "maxItems": 3,
        "items": {
            "type": "number"
        }
    },
    "required": [
        "type",
        "coordinates"
    ]
},
{
    "Error": {
        "type": "object",
        "description": "Error information.",
        "properties": {
            "type": {
                "type": "string",
                "enum": [
                    "Corrupted",
                    "Lost",
                    "Unsupported",
                    "Unknown",
                ]
            }
        },
        "required": [
            "type"
        ]
    }
},
    ],
    "required": [
        "DateTime"
    ]
}

```

```
    }
  }
},
"required": [
  "Type",
  "Samples"
]
}
]
},
"required": [
  "DataID",
  "TransducerID",
  "StartDateTime",
  "EndDateTime",
  "Data"
]
}
```