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FOREWORD

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Draft	Report on voting
JTC1/SC41/316/FDIS	JTC1/SC41/329/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1, available at www.iec.ch/members_experts/refdocs and www.iso.org/directives.

INTRODUCTION

The IoT-based ecological environment monitoring system is mainly for collecting data and monitoring the ecological environment entities (i.e. physical things in the IoT sense – air, water, soil, and living organisms) using various types of sensing devices. Such sensing devices include but are not limited to the following: growth meters for plant growth; infrared digital cameras and video cameras for identifying animal movements; tracking devices for position and location reporting; and physical, biological or chemical sensors for air, water, and soil monitoring. The collected data are transmitted via a network infrastructure, analysed for their relationships and evaluated for the trends of the eco-environment being monitored. With the current IoT and related technologies, for example, information and communication technologies, all these capabilities can be performed in real-time. Therefore, the IoT-based monitoring system satisfies the requirement of the real-time eco-environment monitoring and management in terms of data capture, data analytics, early warning services, and disaster management and emergency management. This system supports the decision-makers, for example, eco-environment managers, government agencies, and citizens, in the maintenance of the ecosystem and in correcting and restoring the ecosystem when damaged or polluted ecological environment is detected.

Eco-environment has been greatly altered with the development of the economy and humanity. The alteration of the eco-environment endangers the health of all living organisms including humans. More efforts to monitor and protect the earth's eco-environment will improve understanding and support corrective actions.

A number of regional scale eco-environment observation networks are constructed to monitor the ecosystem of air, water, soil, plants, animals. Examples of these regional eco-environment observation networks are GEMS (Global Environment Monitoring System), GTOS (Global Terrestrial Observing System), and ILTER (International Long Term Ecological Research). National scale eco-environment observation stations also exist to monitor water, forest, grassland, farmland, lakes, rivers and coastline. These national scale observation stations are parts of global eco-environment observation networks.

The trends of the eco-environment observation stations require united data sharing and networking, being standardized and automated, and likely to become intelligent. These trends are likely to become the requirements of eco-environment monitoring systems. Therefore, IoT-based systems can be applied to the eco-environment observation systems and networks to meet these requirements. The IoT-based eco-environment monitoring system can provide the accurate and comprehensive sensing of the physical entities (i.e. air, water, soil, and living organisms), reliable data transmission and reception, and intelligent information processing.

Since the 1990s, sensor network systems, which transitioned to the most essential part of the IoT-based systems in the 2000s, have been used for monitoring the environment quality, pollution, and living organisms. For example: the CitySense system in the US was developed for real-time monitoring of the environmental pollution in the city; multitudes of air quality monitoring systems have been deployed to monitor air quality and pollution all over the world; China has initiated the sandstorm and acid rain monitoring system; UC Berkeley is monitoring the birds in Great Duck Island; and Australia monitors underwater temperature and brightness of light to protect the coral reef.

Using the IoT technologies for ecological environment monitoring brings the following advantages in the ecosystem monitoring and management:

1) transforming from a single-point monitoring station to a multi-point network monitoring application through networking and data sharing;
2) ensuring the real-time and dynamic observation and measurements by effectively adapting to the monitored objects' complexity and variability compared to the measurements made manually and by legacy systems;
3) enabling pro-active actions toward ecological events in advance rather than reacting after the events take place;

4) realizing a multi-level and unified management of the observation stations and systems;
5) observing the entire ecosystem rather than geographically divided areas or regions (i.e. by using a single point observation) in both macro and micro perspectives; and
6) analysing the relationships among ecological entities to ensure the sustainable ecosystem and its development.

Standardizing the IoT-based eco-environment monitoring systems brings the benefits such as the enablement of on-demand, real-time monitoring for eco-environment, the improvement in the interoperability among all standardized eco-environmental monitoring systems which include hardware and software to realize the EEM worldwide, the full utilization of the observed data for various kinds of eco-environment applications referring to comprehensive functions and services of EEM system including analysis of the relationships between various ecological entities, and the study of the changing trends of the ecosystem.

IoT-based monitoring systems also bring benefits for relevant stakeholders, including the users and builders of the IoT-based eco-environment monitoring systems. The users include the following:

– public users, citizens, data scientists for eco-environment;
– the monitoring organizations such as city environment monitoring organizations and wild area ecosystem monitoring organizations; and
– government agencies responsible for managing the entire ecosystem.

The builders are the developers of the communication modules and integrated devices, sensing devices, and monitoring service platforms for the IoT-based eco-environment monitoring systems.

INTERNET OF THINGS (IoT) – OVERVIEW AND GENERAL REQUIREMENTS OF IoT SYSTEM FOR ECOLOGICAL ENVIRONMENT MONITORING

1 Scope

This document specifies the Internet of Things system for ecological environment monitoring in terms of the following:

– system infrastructure and system entities of the IoT system for ecological environment monitoring for natural entities such as air, water, soil, living organisms; and

– the general requirements of the IoT system for ecological environment monitoring.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 9834-8:2014, *Information technology – Procedures for the operation of object identifier registration authorities – Part 8: Generation of universally unique identifiers (UUIDs) and their use in object identifiers*