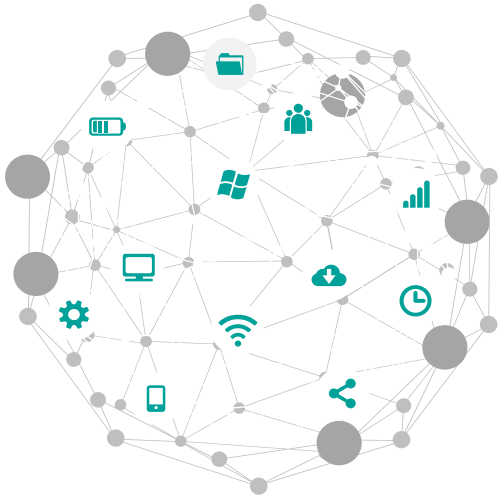
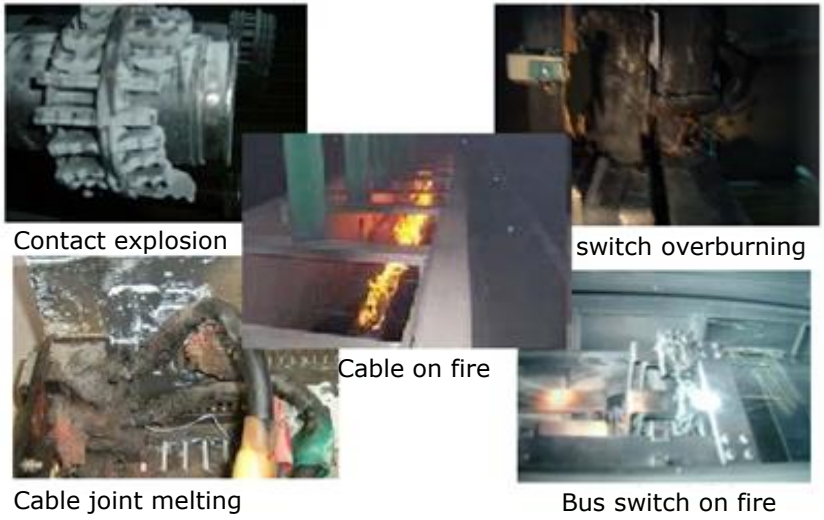
Guide for the Technical Specification of IoT （Internet of Things） Intelligent Terminal within Switchgear

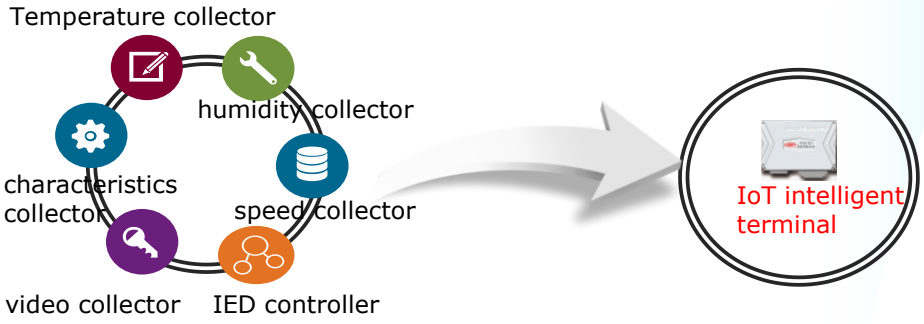
State Grid Xuji Group Co., Ltd.

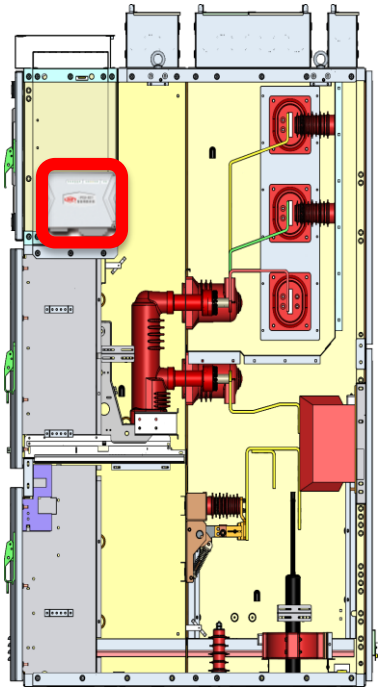


- 1.Background
- 2.Requirements
- 3.Existing Standards Investigation
- 4.Scope
- 5.Working group
- 6.Framework

Intelligent Construction Demand







Temperature monitoring

Monitoring the environmental temperature of switchgear or Ring main Unit (RMU)

Cable temperature monitoring

Monitoring three phases cable temperature to pre-judge the cable health condition

Bus temperature monitoring

Monitoring the bus temperature to analyze the bus health

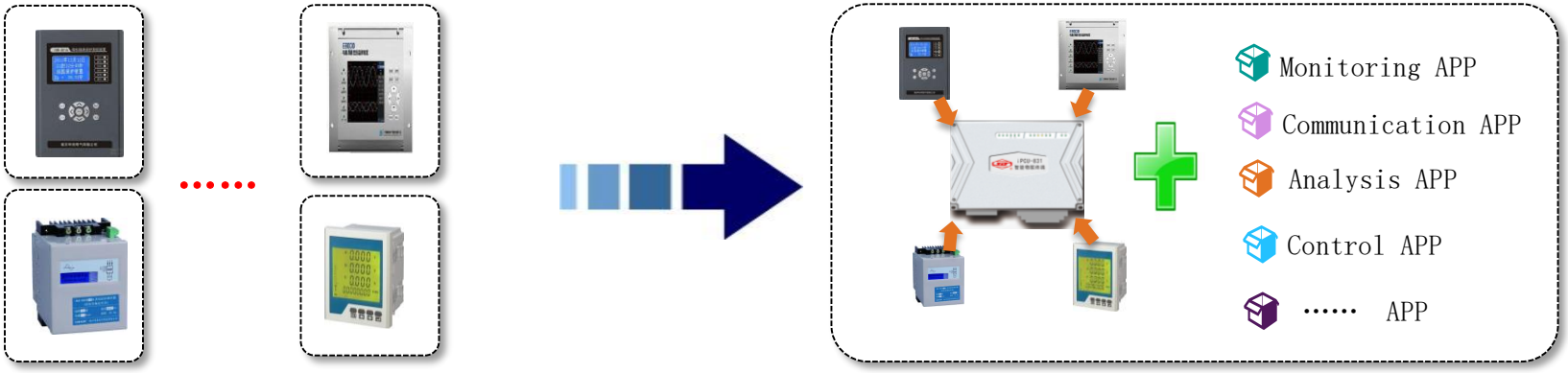
Video monitoring

Monitoring videos of the earthing switch position to realize "double confirmation" accordance with the remote communication state

Mechanical characteristics monitoring

Monitoring the breaker's mechanical characteristics to analyze the operating conditions and lifetime, which will guide intelligent operation and maintenance of switchgear or RMU

Learning from functional mobilephone to smart mobilephone, the intelligent terminal could achieve universal hardware and flexible software configuration, as well as support functional expansion as needed, which combined with many kinds of traditional electrical terminal functions and APP software that contains different requirements



Traditional electrical terminal **IoT intelligent terminal**

Traditional electrical terminal

Single function, repeated purchase, inflexible expansibility and insufficient service capacity, rapid elimination.

IoT intelligent terminal advantages

Share common resources such as CPU, storage and network, adequate scalability of software and hardware, standardized design.

Traditional detection

◆High labor costs

◆Patrol inspection is not timely, no early warning

◆Much more blind spots in patrol inspection

◆Terminal has limitations: inadequate software scalability, proprietary communication, non-standardized design, etc.

◆More electric shock hazard exists in live inspection

VS

Current monitoring

◆lower labor and labor costs

◆real-time monitoring, gives early warning to the faults

◆Historical data query, trend analysis, fault diagnosis

◆Potential failure points could be monitored with pre-judgement and analysis method

◆Improves the efficiency of equipment operation and maintenance of switchgear and RMU

IEEE

Market requirements

GSMA reports that the number of industrial IoT terminals will reach 6 billion in 2020 and 14 billion in 2025, with an average annual growth rate of 21%.

ABB adopts IoT technology to monitor equipment operation data and contact temperature in real time to help users to realize big data analysis and preventive maintenance

Siemens of Germany releases two kinds of gateway devices: "MindConnec Nano" and "MindConnect IoT 2040"

Schneider Electric launches intelligent loop switchgear, based on EcoStruxure architecture of IoT to meet users' increasing demands for digital power distribution operation and management

GE America provides data bus service for the Iot intelligent terminal through the "PredixMachine" device on the Predix platform

Technical requirements

Smart switchgear demands

Flexibility

Simple to realize，offering up to 66% less cables and up to 10% less connectivity components

Scalability

Users could download any functional APP software with universal hardware in the IoT intelligent terminal to realize evolving requirement.

Service continuity

Reliable and simple to service, offering up to 36% less maintenance cost

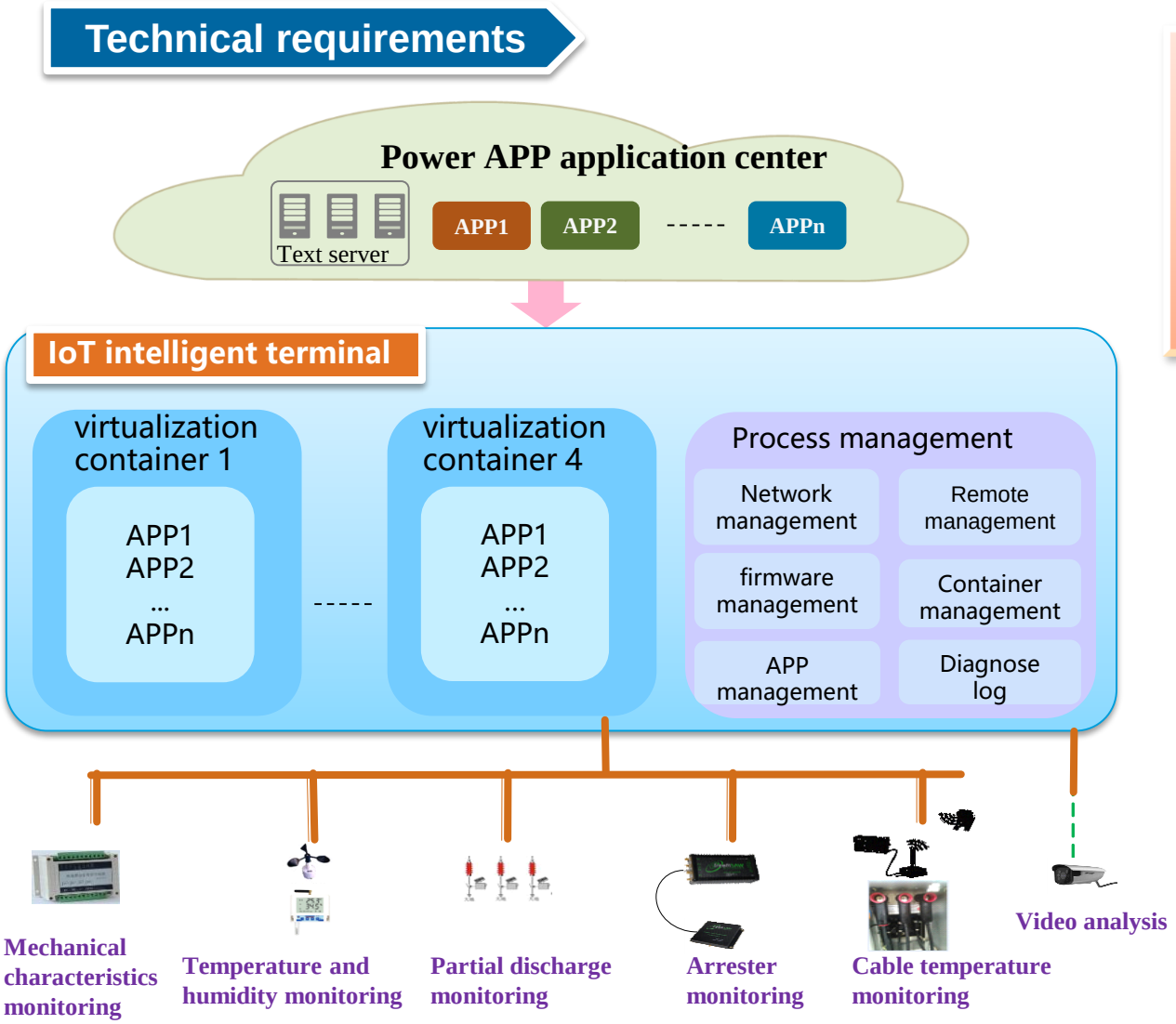
Future proof

Offering upgrade and update solutions with zero downtime

Standard requirements

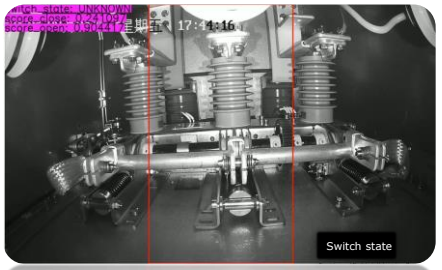
There is no relevant standard to regulate intelligent terminal within switchgear

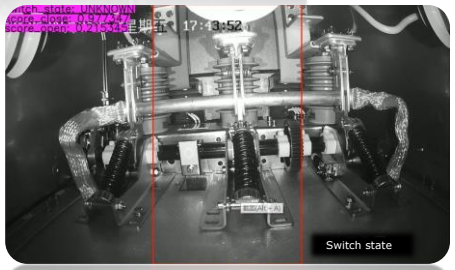
Technical requirements



Artificial intelligence and machine learning function of IoT intelligent terminal:

- **Breaker statement monitoring**
- **Earthing switch monitoring**





Title	Correlation
Arulvizhi, D.Venkatesan, M.VAdivazhgan, Advancement in the Switchgear to Intelligent Switchgear for Smart Grid [J]. IJSRD-International Journal for Scientific Research & Development Vol.7, Issue11, 2020	This paper elaborates the technology of switchgear intelligent construction and proposes the use of intelligent terminals, which will accelerate the pace of the switchgear intelligent construction
BS EN 62271-2004: AC Metal-Enclosed Switchgear and Controlgear for rated voltages above 1 kV and up to and including 52kV.	It is not applicable to the intelligent construction of switchgear and ring main unit (RMU).
IEEE C37.100-2001-IEEE Standard Definitions for Power Switchgear.	The standard just defines the terms for switchgear products, but excludes the functional and technical specification for IoT intelligent terminal
Guide for the Technical Specification of Smart Distribution Transformer Terminal.	The standard is limited to the substation area and is not related to the intelligent terminal of terminals of switchgear and RMU.

- Provides general functional and technical specification for IoT intelligent terminal (as a device) used in intelligent switchgear and RMU, and the system voltage is up to 35kV.
- Addresses various functions and requirements of its environmental aspect, communication and information exchange interface, power supply, hardware and software platform, and advanced application.
- Offers design, manufacturing, operation and testing for intelligent switchgear and RMU.

Entities involved are expected to include:

- State Grid Xuji Group Co., Ltd.
- China Electric Power Research Institute.
- China Southern Power Grid Academy of Science.
- State Grid Xiongan New Area Electric Power Supply Company.
- Newcastle University Upon Tyne.
- Tianjin University.
- Xi'an Jiao Tong University.
- North China University of Technology.
- Datang Telecom Technology Co., LTD.
- Schneider Electric SA.
- HUAWEI Technologies Co., LTD.

PART 01 Overview

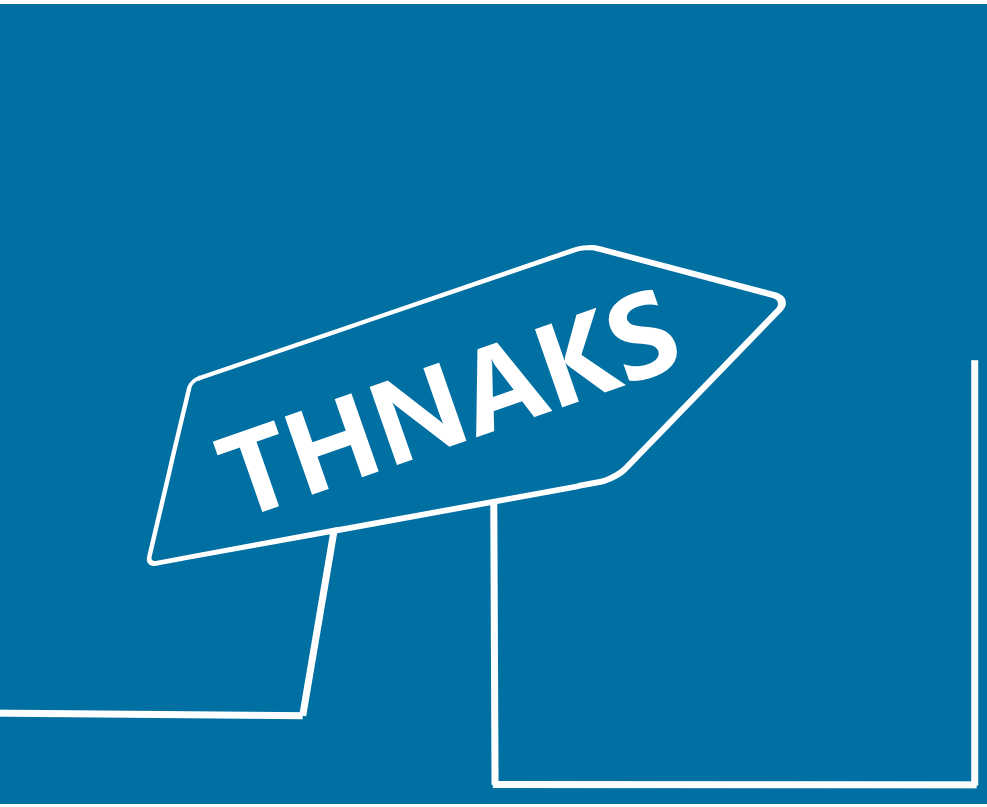
PART 02 References

PART 03 Definitions

PART 04 Functional requirements

PART 05 Technical requirements

PART 06 Appendix


THNAKS

Thank
You!