2021 International Conference on Applied Mathematics, Modeling and Computer Simulation

(CS164) Research on low-cost IoT and its application in improving energy efficiency of distribution networks

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1. background and significance

2021 is the first year of the China's 14th Five-Year Plan. Energy conservation, emission reduction and carbon neutrality are the two major efforts to implement energy conservation and environmental protection. New energy sources such as photovoltaics and wind will gradually replace traditional energy sources such as coal and steel, which are conducive to achieving the goal of sustainable and renewable energy. China's energy-saving industry started relatively late, and the independent innovation capabilities in industry, manufacturing, construction and other fields are not strong, and energy-saving measures and concepts have not been popularized. About 95% of buildings still have not adopted any energy-saving measures. Therefore, in terms of policies and industrial development, the energy-saving market has broad development prospects.

This topic is based on cutting-edge technologies such as the Internet of Things, big data, and artificial intelligence, and builds an energy optimization management system from multiple levels such as distributed energy monitoring equipment, energy digital modeling, energy supply and demand forecast analysis and dispatch, and improve energy utilization efficiency.
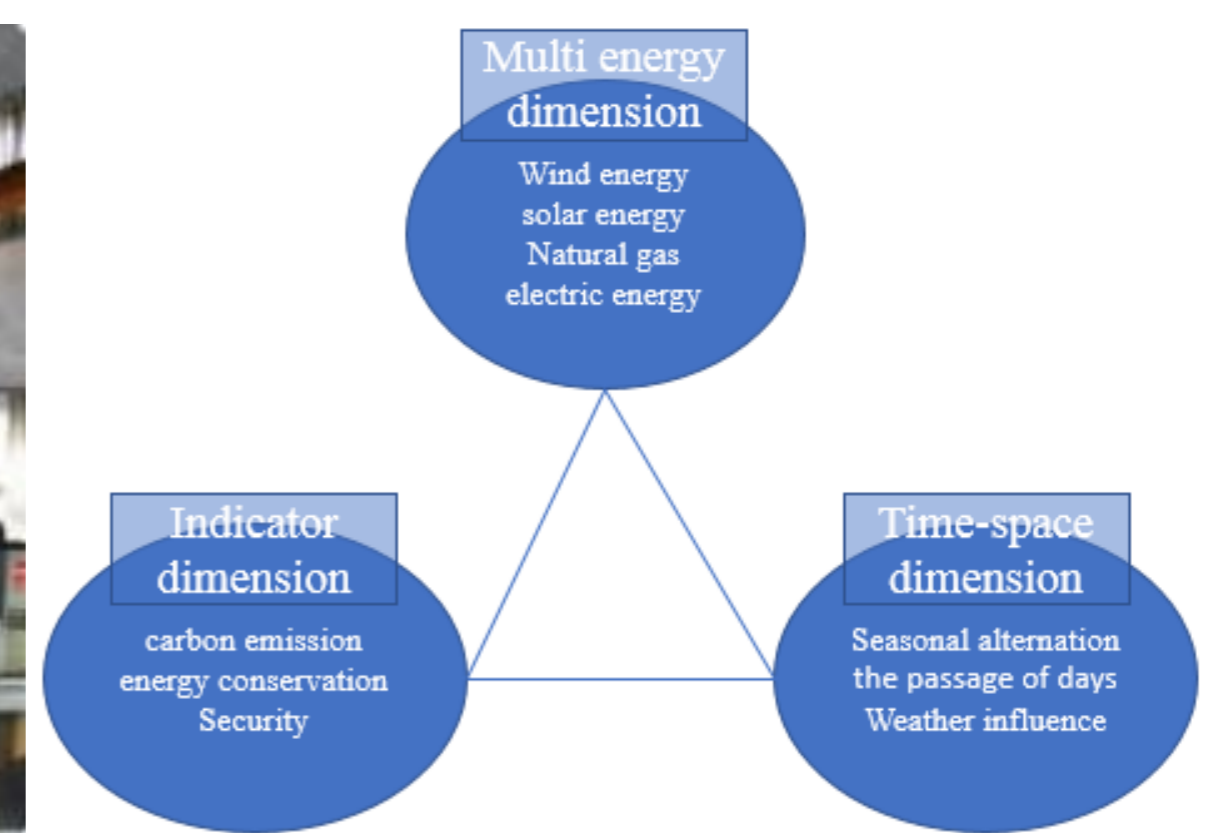

Figure 1. Energy consumption plants

Figure 2. Design dimensions

2. Case background and technical architecture

Taking an industrial park as a case to illustrate choices of the IoT protocol in specific application scenarios. The headquarters of Sunfly Holding Co., Ltd. is composed of a factory area and an office area, with a total construction area of 59000 square meters. The park has 4 buildings with 13 floors. These buildings are equipped with electrical system, water system and intelligent office system. Based on environmental factors, suitable IoT modules are selected here, and the core parts of the three systems are connected to the local area network, so that managers can fully grasp the company's water and electricity consumption in the whole area, and then control energy saving and emission reduction.
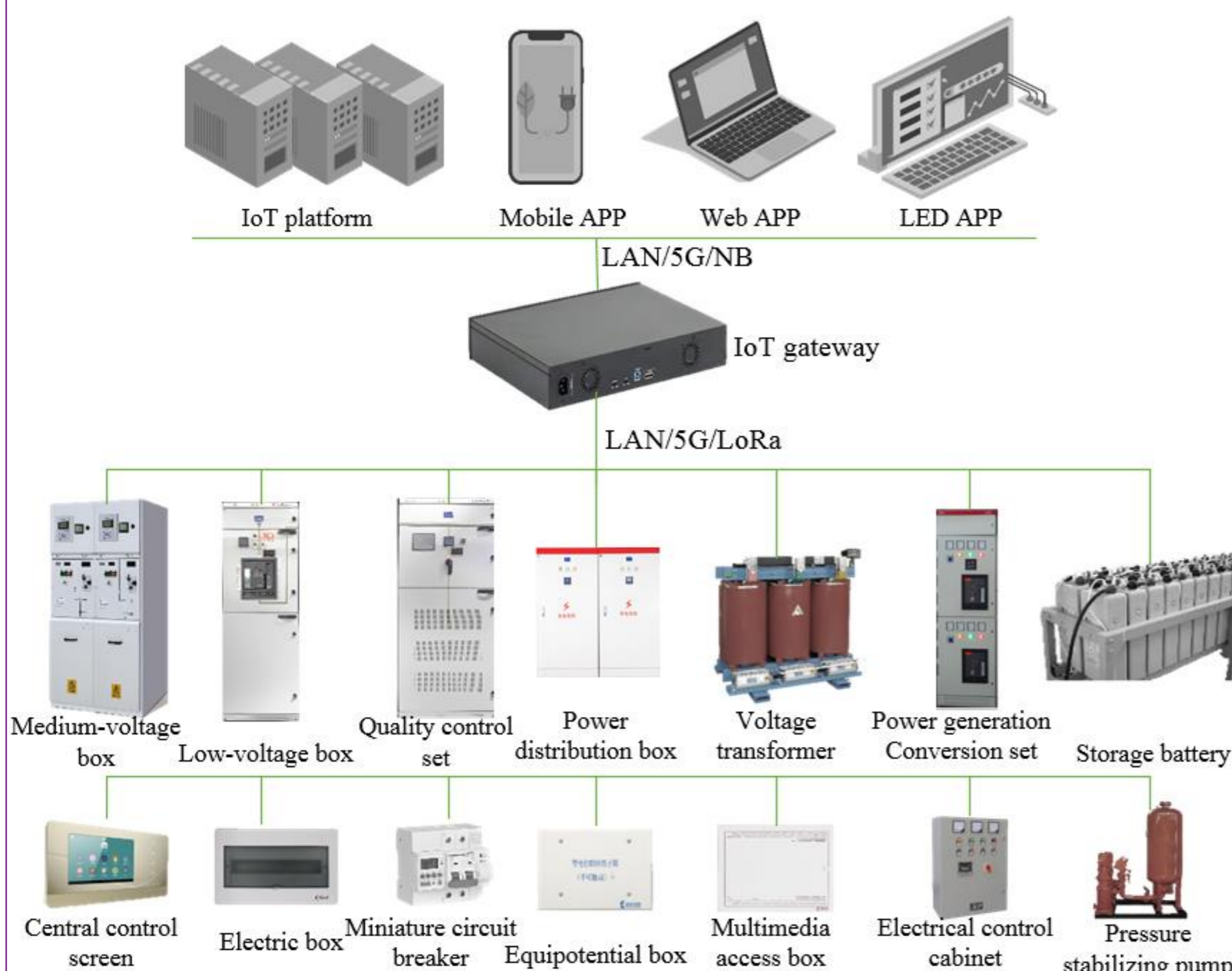

Figure 3. IoT architecture of the headquarters building

3. Introduction to Energy Monitoring System

We have developed an energy detection system based on the above-mentioned IoT architecture, which can monitor and analyze the water and electricity consumption of each floor in the building. Figure 4 shows the 24-hour power consumption of a certain floor, and Figure 5 shows the health status of the electricity meters, water meters, and industrial gateways on each floor.

Figure 4. Trend analysis of water and electricity consumption

Figure 5. Fault and abnormal warning