A Centralized Transcribing System’s Design and Implementation

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Abstract. In order to meet the demands of collecting data of gas meter, electric energy meter and water meter, a centralized transcribing system is proposed. This system is based on EPON+LORA technology to set up the communication network, for transcribing and managing data; and design a platform that can realize data collection, data analysis, classification display, classification billing, fault classification, user management and other services.

Keywords: Electric energy meter; water meter; gas meter; centralized transcription.

1. Introduction
There are 3 kinds of meters in the southern cities, including gas meter, water meter and electric energy meter. These meters are belonging to different companies, with different transmission modes. As the “smart city” project is proposed in China, to enhance an efficient way of collecting water meter, gas meter and electric energy meter data is advanced in many occasions. In this condition, using electric communication network is the best choice, for its convenience and flexibility, and its robustness.

To develop a centralized transcribing system of three kinds of meter, there are two keys considerations.
(1) The network mode. The water meters and gas meters are using bus topology, and the location of the device is in the basement or kitchen; the electric energy meters are based on broadband power line carrier communication, they are installed in the corridor concentrated.
(2) The software design. According to current occasion, the charging systems are belonging to each company, so the centralized transcribing system is made indirectly, though different call interfaces.

According to the considerations listed above, the centralized transcribing system has to solve the problems of network mode and software design.

2. Network Design
The water meter system is based on M-bus topology. The meters are installed in the basement or kitchen, and then linked to the concentrator by cable. The data back to the water company by using GPRS.

The gas meter system is based on Lora technology. LoRa is the most widely used technology for LPWAN (Low Power Wide Area Network) in the sub-GHz unlicensed band[11]. The advantage of using this technology is the devices can be installed easily, but the ratio of on-line devices is not stable.

The power grid is now using “smart electric energy meter” wildly. It is based on broadband power line carrier communication. Due to the cable that can reach everywhere of the building, the data can be gotten easily and rapidly. And the Smart meter has many kinds of application function including
two-way multiple rate measurement, end user terminal real-time control, multiple data transmission modes and intelligent interaction etc. The key point of uniting these three kinds of meter is to design a convenient network in already built building. According to the location of the pipe and transformer rooms, we chose EPON to make these three meters systems connecting. EPON (Ethernet Passive Optical Network) is a type of optical fiber access network technology, which is widely used in telecommunication. It has been initially applied to the distribution automation of power systems and use electricity automation. Fig 1 is the final network topology.

![Diagram of network topology]

**Figure 1.** The network topology.

For the electric energy meter system, a broadband carrier communication concentrator was set in every building, all the electric energy meter send their data to concentrator, and then all the data upward to OLT equipment through the optical fiber, get into the Intranet. For the water meter system, the concentrator data is transmitted back to the water company through GPRS. On the other hand, the centralized transcribing system has to get all data from the water meters. So a bypass block was set up beyond the concentrator, and the data of water meter can be directly transmitted back to the centralized transcribing system directly by the EPON network. The gas meter adopted LORA technology for wireless remote transmission. The system was built up by LORA gateway and server. Two LORA gateways were set up in each building to connect all the gas meters, with a photoelectric converter in the EPON network, the data can be sent back to the LORA server finally.

### 3. Software Design

The centralized transcribing system includes three modules. They are communication module, data storage module, data analysis module and application service modules. Fig.2 shows the relationship between these modules.
Communication data acquisition module is used to host and terminal interaction, establish communication between master station and the terminal, including, but not limited to parameters and instructions issued, acquisition task execution, receiving terminal report message, message parsing and data storage, and other functions.

Data storage module is divided into real-time database and business database. The real-time database stores collected real-time data, and the business database stores archival data and transferred real-time data, and docking with the other business subsystem of data tables.

Data analysis module includes real-time computing and business analysis. Real-time calculation is based on real-time database to realize real-time power calculation, power use alarm analysis and other functions. Business analysis based on the business database data analysis, the realization of historical electricity calculation, regional energy analysis.

Application service module has the functions of basic file management, display the raw data, operation monitoring.

4. Summary
The centralized transcribing system is part of infrastructure for the “smart city”. It provides a solution for paying the cost of gas, water, electric power with one ticket. This system improved the efficiency of charge collection, and explores the construction mode of intelligent community; it is worth to be popularized in other cities.

Acknowledgement
This research was financially supported by the National Science Foundation.

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