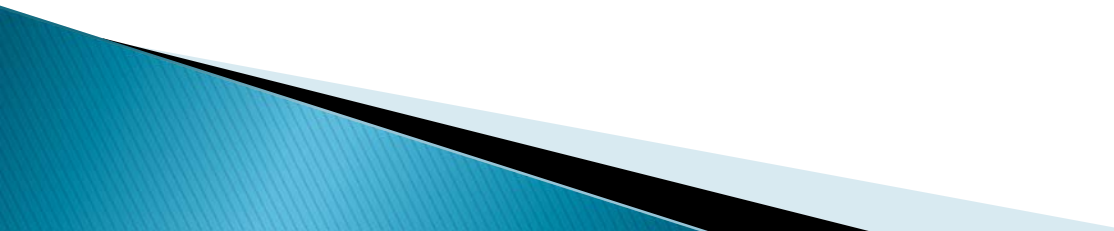# Supervisory and Energy Management System of Large Public Buildings

Reviewed by: Jie Wei
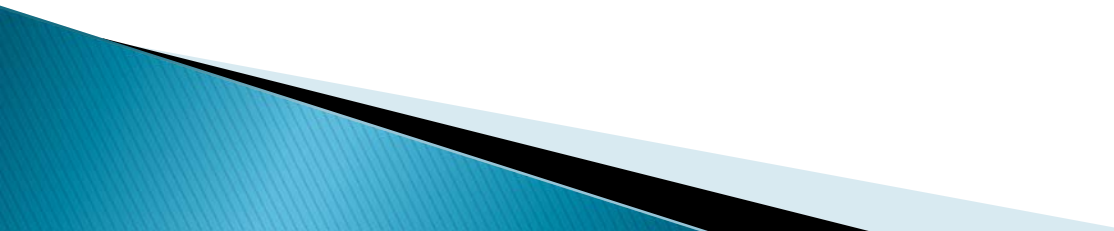
Why we need BEMS ?

- **BEMS**– Building Energy Management Systems

- Environmental–friendly requirement

- Huge energy consumption

- Effective

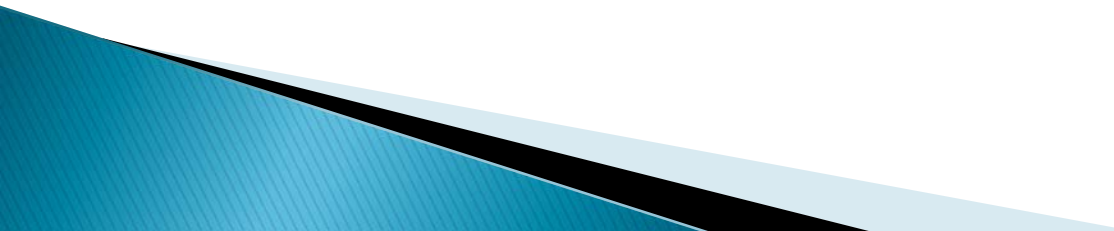# What is BEMS ?

- BEMS is developed for energy consumption monitoring and management.

- **Expectation** : energy consumption decrease and better efficiency

- **Management process**: monitor and control the operating systems within a building

- BEMS combines both intelligent and green building technology

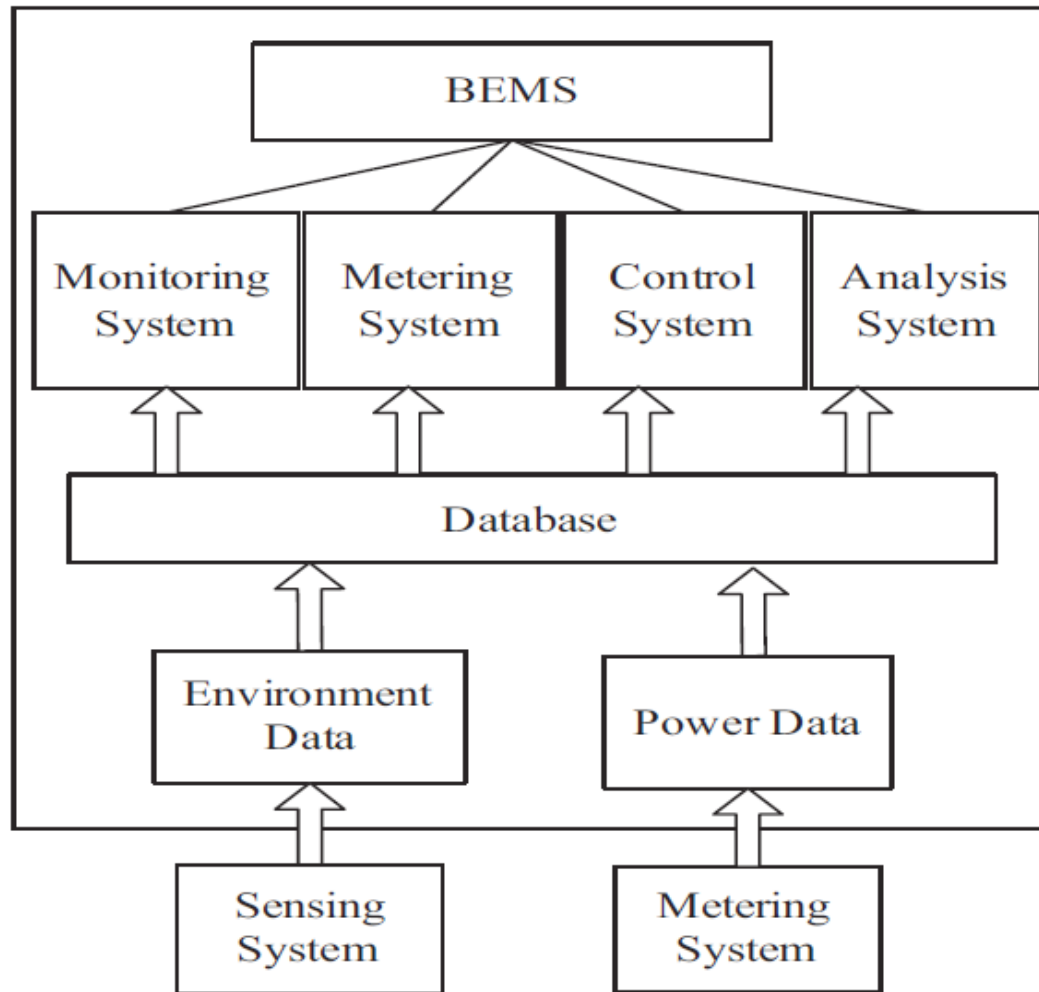# What can a BEMS do?

- Detects abnormal energy utilization

- Adjust the running strategies of devices

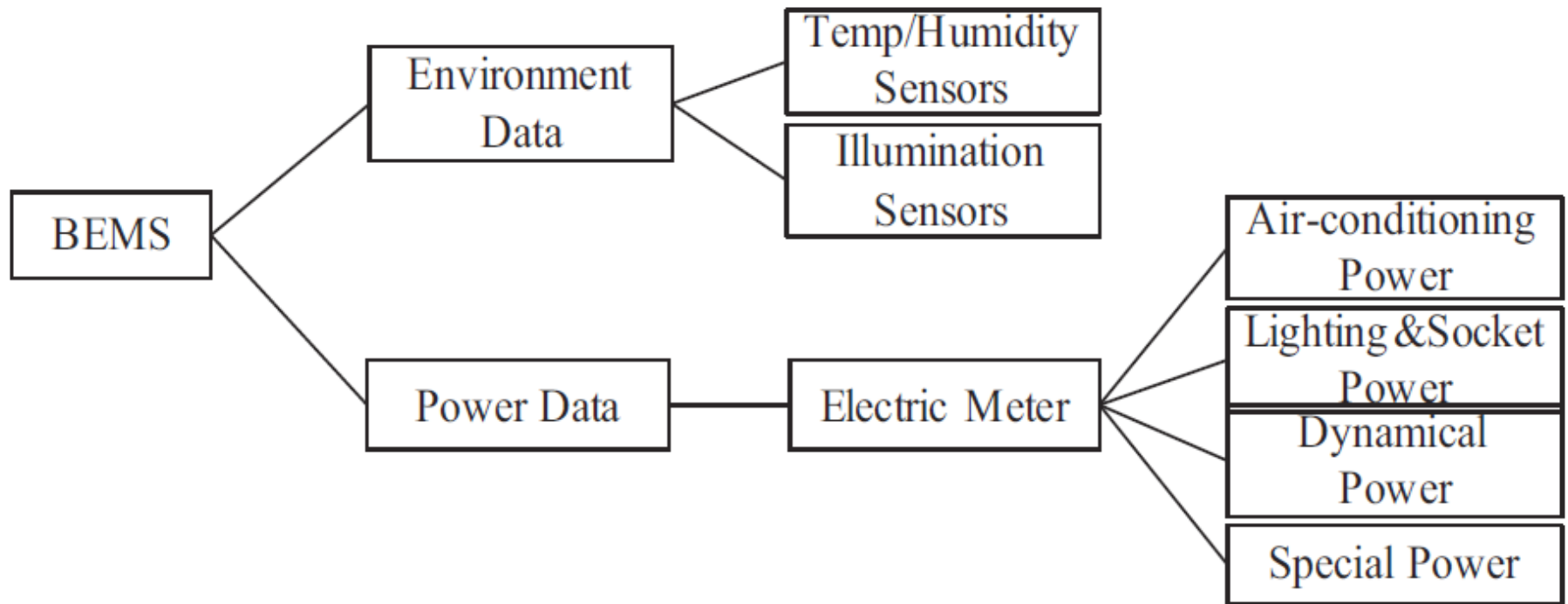- Ensure a comfortable indoor environment

- Eliminate energy loss.

What does BEMS monitoring need to do?

- 1) Improve building management

- 2) Find inefficient equipment

- 3) Identify abnormal energy consumption

- 4) Decrease peak electrical demand

BEMS system structure:

Monitoring Data classify Chart

Framework of the system

Energy Optimization	Parameter Optimization Operation Optimization
Performance Evaluation	Energy Analysis Energy Audit
Data Interpretation	Interface of Protocol Interpretation of Packet
Data Transmission	Zigbee/RS485 Transport Protocols
Data Acquisition	Environmental Information Amount of Energy Consumption
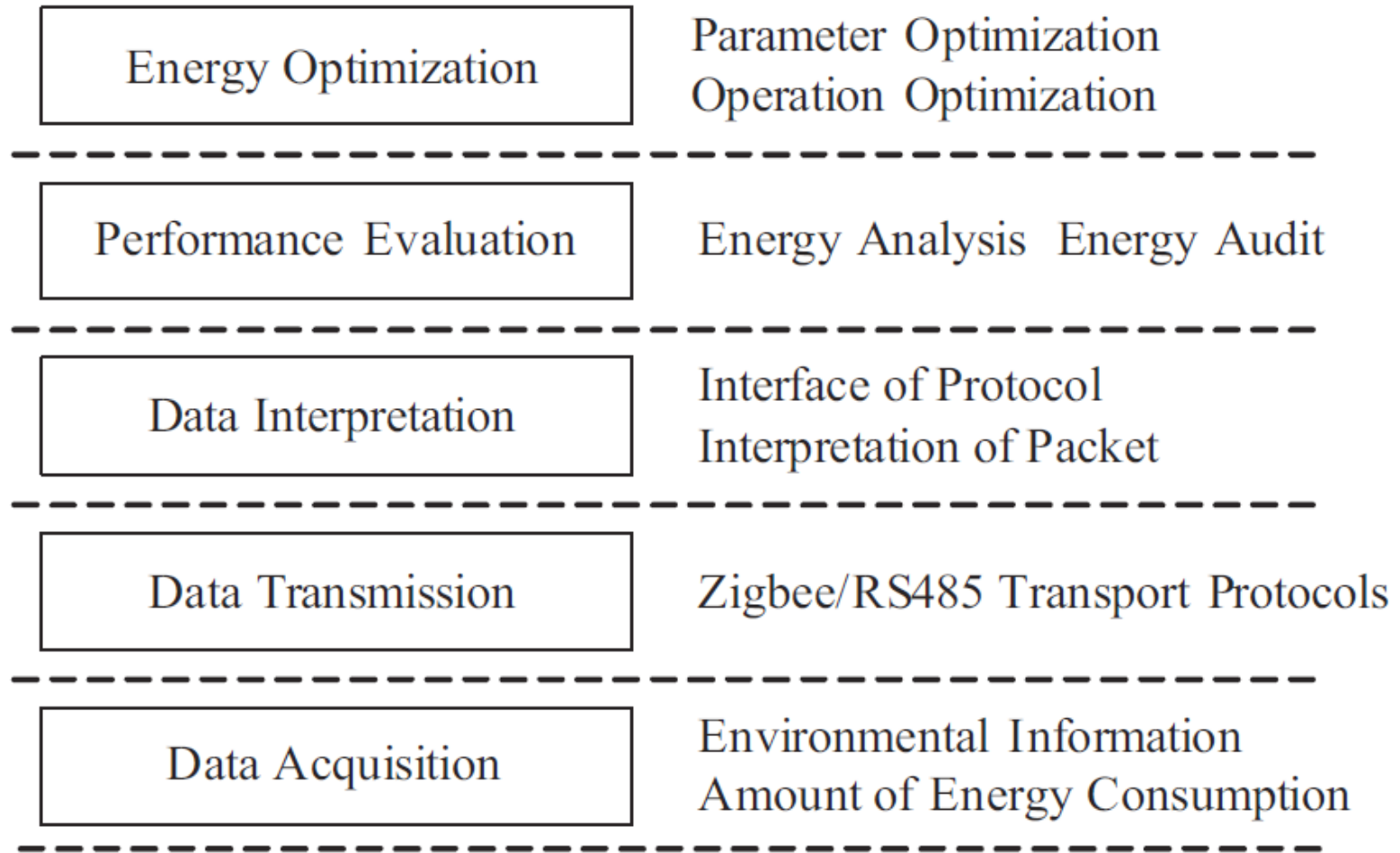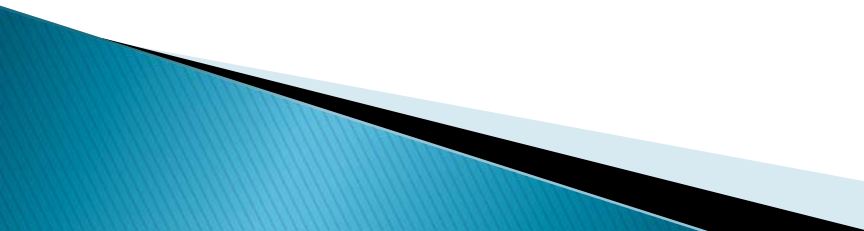
Data Acquiring –The Amount Of Energy

▸ Modern Building Automation System(BAS)

Data Acquiring –Environment Information

- A wireless sensor network (WSN) adopted in the BEMS
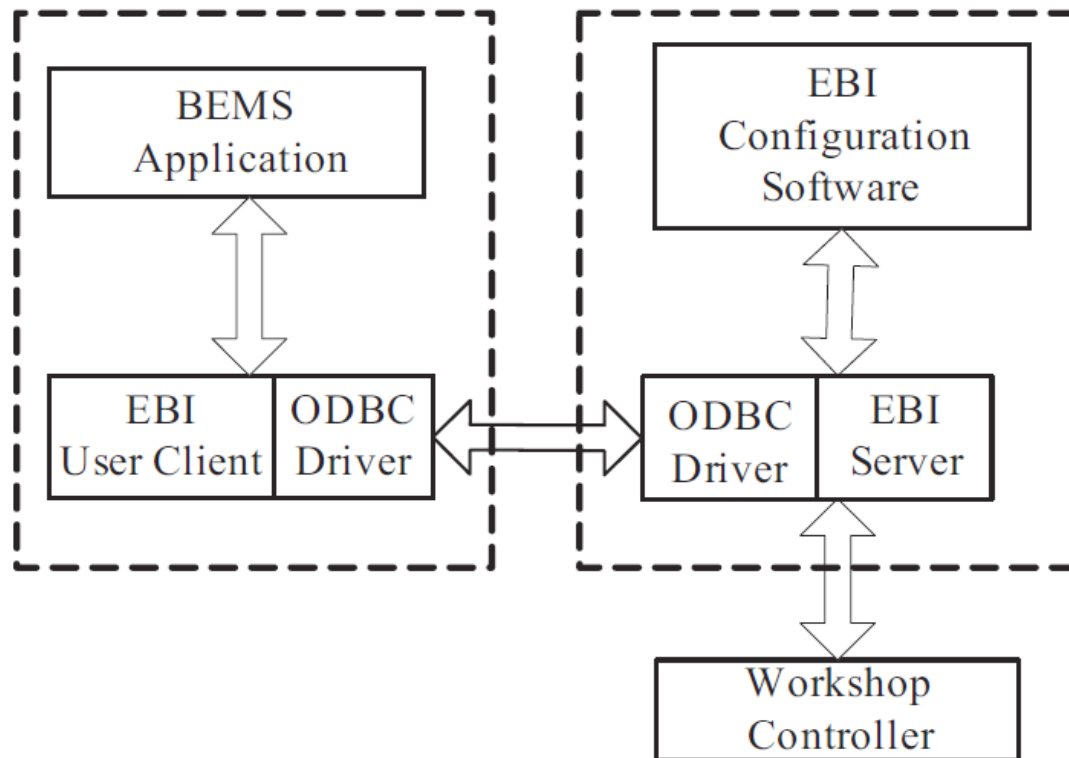
- **Reason**: WSN technology enable a flexible and enhanced monitoring of conditions in and around buildings

- WSN operation:

1) Spatially distributed autonomous sensors
2) Monitor environmental conditions cooperatively
3) Transfers the information to the BEMS centre

Data Transmission

- ### Raw Data Packet (UART –Universal Asynchronous Receiver/Transmitter)

SYNC_BYTE	Packet Type	Payload Data (TinyOS Message)	SYNC_BYTE
0	1	2 ⋯ n-1	n

- ### Payload Data (Tinyos Message Tos_msg):

Address		Message Type	Group ID	Data Length	Payload Data	CRC	
0	1	2	3	4	5 ⋯ n-2	n-1	n

- ### Mesh Message And Senor Message

Source Address		Origin Address		Sequence Number		Application ID	Sensor Board ID	Sensor Packet ID	Parent		Data Payload
0	1	2	3	4	5	6	7	8	9	10	⋯

How does it works?

▸ From raw data packet from UART

7E 00 33 7D 1B 00 00 01 00 00 00 00 83 81 7E 00
6D 01 1D 02 E2 01 C8 00 00 00 00 00 00 00 00 00

▸ Translate based on defined protocols as:

1) Address=0x007E, the packet is from UART;
2) Message Type=0x33, it is a multi-hop message;
3) Group ID=0x7D, Data Length=0x1B, the payload data
has 27 bytes;
4) Sensor Board ID= 0x83

Then we can obtain the temperature at that specific room is:

$$Temperature = \frac{1}{a + b \times \ln\left(R_{thr}\right) + c \times \left[\ln(R_{thr})\right]^3} - 273.15$$

Energy management and control

▸ The WPF is selected to build the software system. (Microsoft's latest technology)

▸ Reasons :

1) WPF provides a new development model
2) Enable interface display
3) Separately functional logic code
4) Integrated desktop applications and browser applications

Data flow model
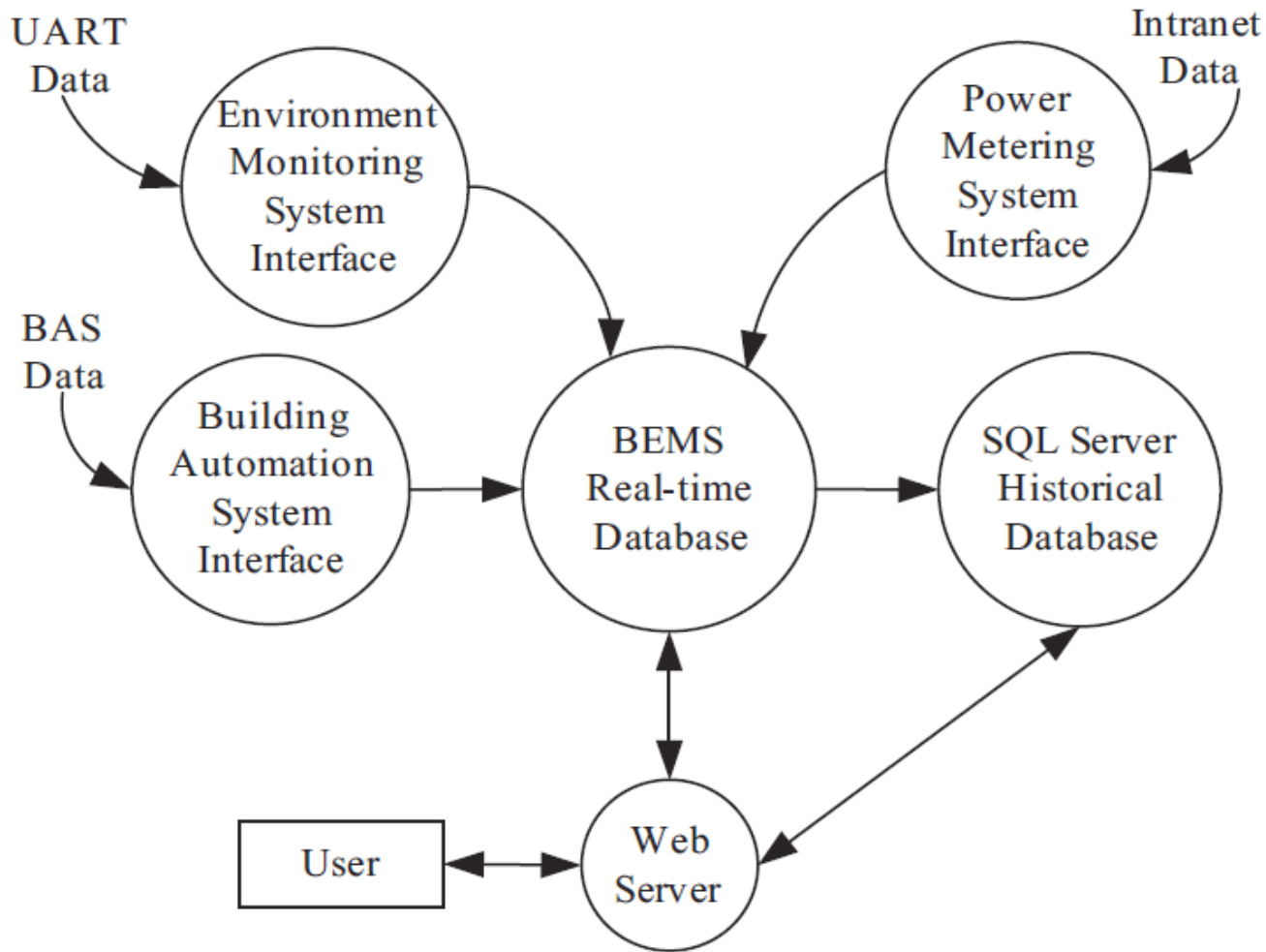
Conclusion

- This paper proposed a new energy conservation supervision system and strategies for energy management in large public buildings

- Wireless sensors are deployed to monitor the environment indoor temporarily and the BAS is integrated into the BEMS.

- The BEMS system developed to improve operation of the equipments, promote the energy efficiency and cut down energy consumption