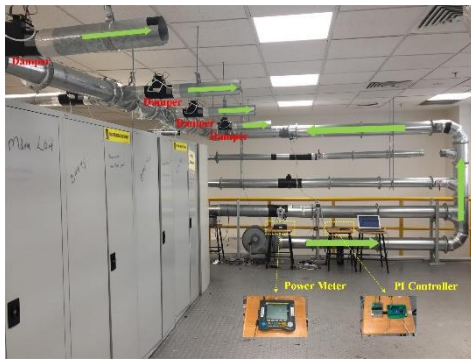
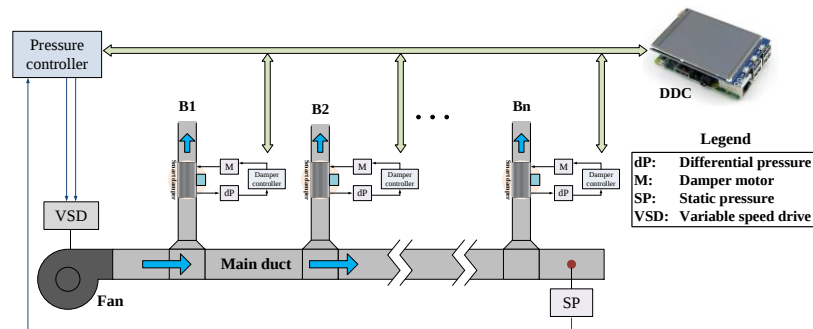




An comply with established requirements. To maintain the necessary IEQ and enable economic operation of the system essential function for Air-Conditioning Mechanical Ventilation (ACMV) systems is to supply treated air to the air-conditioned space for



Indoor Environment Quality (IEQ) to, the ventilation air supplied to each zone should be adjusted to the desired value. This process can also be called as air balancing. In traditional method, air-balancing needs to be performed during the commissioning phase following an iterative procedure based on an engineering rule of thumb and to be conducted by the qualified engineers. At each iteration, the dampers are adjusted based on the current measurements of terminal air flowrate and pressure drop. Due to the coupling effect, adjusting one damper will affect the air flowrates of the neighboring terminals, the adjustments are repeated until all branches reach the designed airflow rates. This procedure is time-consuming, costly, and greatly depend on the engineer's experience. It is estimated that air balancing requires 1.5 man-hour per terminal. We developed an intelligent air balancing system for net zero energy buildings, i.e., a low cost and easy-to-implement Intelligent Air Distribution System (IADS) for dynamic control of building ventilation was developed. The system consists of Indoor Air Quality Sensors, Indoor Controller, Smart Damper and Direct Digital Control System. The Direct Digital Control System receives data from the indoor controllers, Smart Dampers, and fan to build and update the mathematical model for the air duct network. The intelligent adaptive optimization algorithm then computes the required damper positions and fan speed to achieve optimum working conditions in terms of the good IEQ and minimum energy consumption. The designed IADS system can automatically adjust the supplied airflow of each terminal to the desired value while ensuring the energy consumption of the ventilation system reaches the lowest value.

Project Principal Investigator: Prof. Cai Wenjian/NTU

Applications:

- Automatically and accurately balances the supplied airflow of each terminal in air conditioning and mechanical ventilation systems.

Capabilities:

- Employs “network control systems” concepts and algorithms to control the airflow rate.
- IADS is designed to automatically balance the air duct system, with a user-friendly software interface.
- IADS is equipped with fault detection algorithms to detect common faults in duct systems.

Benefits:

- *Better Indoor Air Quality:* IADS provides accurate air flowrate control for every zone with the deviation less than 4%. The response time of the change in air flowrate is greatly reduced, which significantly increases the controllability on air flowrate.
- *Energy Saving:* The IADS enables a smooth control of the fan speed to match the supply volume of air to the desired value which can significantly reduce the fan power consumption.
- *Rapid deployment:* All components in IADS are connected into the wireless local area network. The installation is convenient for avoiding running electrical signal wires.
- *Low cost:* All components in IADS are affordable and easy to install and the system commissioning is fully automatic without the involvement of professional engineers. The system is extremely competitive in the industry for providing high quality air distribution solutions.

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