Scalable Personalized Thermal-Comfort Platform (SPET)  
SPET 節能空調調節平台

Summary

Some opine that air conditioner is a need instead of a luxury in the humid and sizzling summer in Hong Kong. But setting the air conditioner at a temperature too low is wasteful and may even make users feel uncomfortably cold. Until researchers from PolyU’s Department of Computing developed the Scalable Personalized Thermal-Comfort Platform (SPET), there was no technology to let users of centralized air-conditioned offices express their feelings. The platform takes into account environmental factors, personal data and user feedback to calculate the best temperature most users are comfortable with. It also proves to save 18% of energy and improve user thermal comfort by 33.8% in a test trial.

Main Story

One of the key purposes of scientific researches and inventions is to make our life better. For example, air conditioning system is supposed to make us feel cool and comfortable in summer. But feelings are subjective and one man’s comfortable temperature could be too low for others. In Hong Kong, most people working for prolonged hours in offices with central air...
conditioning find the temperature on the low side. This incurs
tremendous cost and energy wastage while sacrificing the comfort of
the users. In light of this, Dr Dan Wang, Associate Professor,
Department of Computing, The Hong Kong Polytechnic University
(PolyU), led a research team in devising the Scalable Personalized
Thermal-Comfort Platform (SPET) that allows users to vote on the
temperature they prefer. In a test trial, the platform helped save 18%
of energy and improve user thermal comfort by 33.8%.

**Physiological thermal comfort model**

“Smart” has been one of the most mentioned tech buzzwords in our
daily life. Our phones are smart. Our cars are smart. Our homes are
smart and of course, a city can only be smart if most of its
skyscrapers are smart. One criterion to judge whether a building is
smart is its energy efficiency. According to a report by EMSD, energy
consumed by the commercial sector accounted for 65% of Hong
Kong’s total energy consumption in 2014. Half of that energy went
to air conditioning. In other words, to conserve energy, starting with
air conditioning makes a lot of sense.

Dr Wang believed most building managers would rather set the
temperature lower than needed because users may complain if it’s

生理溫感舒適模型

現今，“智能”一詞充斥著我們的日常生活：智能手機、智能汽車、智能家居等……當然，要稱得上智能城
市，當中的建築物也必須具備相同的智慧才行。我們可以循多個準則判斷建築物是否具備智慧，其中一個是節
能效率。電力工程署的報告顯示，2014年香港商業用電量佔全港總耗電量65%，而空調的耗電量又佔商業用
電量一半以上。由此可見，要節約能源應先從空調著手。

王博士認為，大多數業管理者寧願將空調溫度調得過
低，也不想被用戶投訴不夠冷。他說：「過去幾十年
間，研究人員一直建議把辦公室溫度設定在攝氏21至
23度之間，以達到最高的生產力。不過，舒適度是主
觀的；要真正提升生產力，最有效方法莫過於建立一個
共通的平台，讓使用者一起表達感受。」自1970年代
not cold enough. "For decades, researchers have been suggesting an office temperature between 21 to 23°C to optimize productivity. But user comfort is subjective and we believe a platform that lets users express how they feel would be useful," said Dr Wang. In 1970s, researchers started publishing papers on the physiological thermal comfort model, outlining the factors that influence people's feeling about a certain temperature. "Generally speaking, a person would feel hot when the body generates more heat than the heat loss. Personal factors such as metabolic rate, sex, weight, body fat level, age and clothing all affect thermal comfort. So are other external factors. We tried to factor them in as far as possible."

A voting system for indoor temperature

The Scalable Personalized Thermal-Comfort Platform (or SPET in short) collects personal information of the users, such as weight, height, sex and BMI, via a smartphone app. Then users may vote whether the existing temperature is perfect, too cold or too warm. "The platform also collects external data such as the time, outdoor and indoor temperature, fan speed and ultraviolet index. Such figures alongside the personal data of all users would be incorporated in a formula to calculate the best indoor temperature that most users are comfortable with. The air conditioning system would then be set at that temperature," explained Dr Wang.

However, not all users in an office would vote. In such cases, the platform has a cross-learning algorithm to make the result more representative. "The platform can learn from past records to deduce the user's preference on a similar day at the similar time. Besides, the BMI of the user not voting is used as a basis and cross reference to preferences among other voting users of the similar BMI is made for calculation," he added.

In a three-week trial in a 484-square-foot office with 13 workers, users expressed a level of thermal comfort increased by 33.8% while 18% less energy was consumed on air conditioning. Average indoor temperature was raised 1.75°C. The platform can be easily retrofitted on existing central air conditioning system without large-scale modification.

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