1. Experimental Devices

* Software
  + Intelligent Thermal Comfort Management (iTCM) system [1]
* Hardware
  + Building-in-Briefcase (BiB) device [2]
  + Microsoft Band 2 [3]

[1] W. Hu, Y. Wen, K. Guan, G. Jin and K. J. Tseng, "iTCM: Toward Learning-Based Thermal Comfort Modeling via Pervasive Sensing for Smart Buildings," in IEEE Internet of Things Journal, vol. 5, no. 5, pp. 4164-4177, Oct. 2018. doi: 10.1109/JIOT.2018.2861831

[2] Weekly, K., Jin, M., Zou, H., Hsu, C., Bayen, A. and Spanos, C., 2014. Building-in-briefcase (bib). arXiv preprint arXiv:1409.1660.

[3] Microsoft Band 2: <https://en.wikipedia.org/wiki/Microsoft_Band_2>

2. Experimental Procedures

We conducted the experiments in a controllable chamber equipped with independent HVAC systems.

1. Before the experiment
   1. We set up both hardware (HVAC system, BiB device, smartphones, and Microsoft Bands) and software (mobile App and back-end server). Table 1 lists the collected various variables and the corresponding sampling intervals.

Table 1 List of variable sampling interval

|  |  |  |
| --- | --- | --- |
| **#** | **Variable** | **Interval** |
| 1 | Actual thermal comfort votes (ASHRAE 7-point scale) with timestamp (date & time) | 5-25 min |
| 2 | Burned calories (kcal) |
| 3 | Air temperature (°C) | 2 min |
| 4 | Relative humidity (%) |
| 5 | Heart rate (bpm) | 1 sec |
| 6 | Skin temperature (°C) |

* 1. Each experiment consists of a 30-minute preparation session and a 3-hour data collection session. To obtain participants' actual comfort votes from different room temperatures, we implement each experiment session under one of the following six thermal environments: 1) 18°C-20°C; 2) 20°C-22°C; 3) 22°C-24°C; 4) 24°C-26°C; 5) 26°C-28°C; 6) 28°C-30°C. Moreover, one research student is allocated to be in charge of conducting each experiment.

1. During the experiment
   1. Preparation Session: During the preparation session, first, we pass the consent forms to all participants for reading and signing. Then, we briefly introduce our experiment processes and guide them to use our developed mobile App (e.g., save personal information, set clothing settings, submit thermal comfort votes).
   2. Data Collection Session: During the data collection session, we only allow participants to do some light-weight tasks (e.g., read books, do homework) to simulate the general indoor environment (e.g., classroom, office). Every 10 minutes, research student will remind participants to send their thermal comfort votes. To obtain accurate feedback, we require participants to submit their votes within several seconds. Since it is difficult to ensure everyone to send the vote simultaneously, the submission interval is from 5 to 25 minutes, as listed in Table 1. Meanwhile, we also record each participant's total amount of calories burned during the submission interval to calculate the personal metabolic rate.
2. After the experiment
   1. After the completion of each experiment, to avoid affecting the next session and ensure the accuracy of the measured data, the research student will reset all Microsoft Bands to remove previous participants' bio-information.

3. Experimental Durations

Following the above experimental procedures, we divide our data collection experiments into the following three stages.

* Three-Week Preliminary Experiment: In this stage, we recruited 30 participants. Our goal is to test and debug our iTCM system, especially the mobile App. Meanwhile, we want to collect some data for preliminary analytics.
* Three-Month General Experiment: In this stage, we recruited 241 participants. Our objective is to collect sufficient data to support our machine learning research for the generic thermal comfort modeling.
* One-Month Particular Experiment: In this stage, since there are no female applicants, we only recruited three fixed male participants. We aim to collect some data for personal thermal comfort modeling.