Heat Transfer Calculation Blurb

To accurately measure the energy savings that can be realized using an actuating blind system, the amount a room will heat up during the summer months when sunlight hits a south facing window directly must first be determined. We focused on finding the simplified worst case scenario for heat transfer into the room.

To start, energy data from Austin, Texas in 2010 in J/m2 recorded every hour was found. Assuming the worst case scenario using a single pane glass window, 100% of this energy would pass through the window into the room. This energy can be assumed to contribute partially heating up the air in the room and partially to heating the walls, and of the energy the absorbed by the walls, 100% of it would flow into the ambient air in the room through conduction. This is shown by the following equation.

$$∆T=\frac{Q}{Cpwall\*Awall\*twall+Cpair\*Vroom}$$

Where Cpwall and Cpair are the specific heat capacities of the wall and the air respectively, twall is the thickness of the wall, Awall is the area of the wall, and Vroom is the volume of the room. Q can be found by multiplying the average energy data by the surface area of the window through which the light is shining.

For a hypothetical room with dimensions 3m by 3m by 2.5m and a window of Area 3 m2, the temperature rise in the room for any given day in August would be 21 degrees Celsius.

For the situation with blinds placed on the outside of a house covering the window, it is assumed that none of the energy reaches the window, causing no increase in temperature within the room.

To relate this temperature difference to a realized savings in energy costs, we will calculate the energy cost to run an air conditioner over the course of the day. Specifically the amount of energy that is needed to cool a room per degree Celsius, and lastly convert that to a dollar amount representing the saving that can be accumulated by using this automated blinds system.

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