

Mechanical Engineering Thesis Defense

Smart HVAC Zoning for Residential Buildings

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abstract

The concept of this thesis came up as a part of the efforts being devoted around the world to reduce energy consumption, CO₂ emissions, global warming and ozone layer depletion. In the United States, HVAC units in residential buildings consumed about 350 billion kWh in 2017. Although HVAC manufacturers are investing in new technologies and more efficient products to reduce energy consumption, there is still room for further improvement. One way of reducing cooling and heating energy in residential buildings is by allowing the centralized HVAC unit to supply conditioned air to only occupied portions of the house by applying smart HVAC zoning. According to the United States Energy Information Administration, the percentage of houses equipped with centralized HVAC units is over 70%, which makes this thesis applicable to the majority of houses in the United States. This thesis proposes to implement HVAC zoning in a smart way to eliminate all human errors, such as leaving the AC unit on all day, which turns out to be causing a serious amount of energy to be wasted. The total amount of energy that could be saved by implementing the concepts presented in this thesis in all single-family houses in the U.S. is estimated to be about 156 billion kWh annually. This amount of energy reduction is proportional to the electricity bills and the amount of dollars paid annually on energy that is technically being wasted.

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