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**Team Name: Peltier Heating and Cooling**

**Elevator Pitch or Senior Design 2019-2020\**

Hello, my name is Eniola, a member of the Peltier senior design team and what you see in front of you is the Peltier heating and cooling unit that we designed and built.

In our current economical market, commercially sold air conditioning units are harmful to the environment due to the refrigerants present in them. Refrigerants are substances used in refrigeration and they are harmful to the environment in the sense that they cause damage to the ozone layer which would lead to global warming which is ironic considering it is used for cooling.

Our project served to create an energy efficient system that not only tackles this problem by not possessing any refrigerants but to also be used as an educational instrument to inform students about its effect that enables radiant cooling as well as the possibility for heating an environment using thermoelectric modules.

Thermoelectric modules (TEMs) are small, lightweight devices that offer cooling on one end and heating on the other (as shown) by creating a temperature difference when an input power is flowing through them, this is also known as the Peltier effect. The way it works is that when power flows into the thermoelectric module, one end of the module absorbs heat while the other releases that heat thus making one side cold and the other hot. A problem with using the thermoelectric modules for continuous cooling and heating is that eventually the side that is cooling reaches a point whereby is stops absorbing heat and begins to reject heat and to tackle this problem we made use of these modules along with heat sinks (as shown) in order to ensure that both ends of the TEMs are cooling and heating respectively.

A heatsink is a device that helps with the dissipation of heat from a surface. There are various types of heatsinks such as air cooled, water cooled, and even a combination of both air + water cooled heatsinks. The type of heatsink our team settled upon is an air-cooled heatsink as it was lightweight, cost effective and offered an efficient dissipation of heat through the inclusion of a fan.

The thermoelectric modules along with the heatsinks (as shown) are attached to our ceiling panel made of aluminum which we chose due to its high conductivity which would allow for cooling due to radiation to occur.

There were several challenges that you may have questions regarding but let me address some likely ones. To allow our system to be energy efficient, we added Phase Changing Materials (PCMs) which would allow for the ceiling panel to still provide cooling at our desired temperature over a period of time when our system has been turned off. We also made use of Structurally Insulated Panels (or SIPs) to make up our walls and base of the system because they offered high resistance to heat absorption thus making our system require less power to cool to the desired temperature to reach thermal comfort. We also included a dehumidifier into our system to ensure that condensation does not occur as well as a hygrometer to monitor the levels of humidity. Lastly, our system features a user-friendly interface designed by the only two computer engineers in our group and offers the ability to determine the temperature inside the system even when a person is inside.

As I mentioned earlier, the thermoelectric modules work under what is known as the Peltier effect but there is also another effect that they can function on known as the See-beck effect. By creating a temperature difference between two ends of a thermoelectric module, you can generate a certain amount of power. This is the See-beck effect and a thermoelectric module being used under this effect becomes a thermoelectric generator. The reason why I am explaining this effect is that our system also displays this by powering the array of LED bulbs (as shown) which has been connected to eight thermoelectric generators placed around our systems ventilation duct. By making use of the heat that is dissipated from the heatsinks as well as the cooling occurring in our system, we create a temperature difference thus producing a current from the thermoelectric generators. Our team did this because the end goal is for our system to be used in the school’s heat transfer lab in order to teach future students the possibility of radiant cooling and heating through the Peltier and See-beck effect.

All these features make up our product and we know that it has the potential to compete with current available systems. Thank you.