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Development and Evaluation of a Low Cost Radial Cooling System

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Abstract:-

This project is designed to outcome the traditional coolers which are not much efficient and more power consuming. The two stage radial cooling is also known as "Indirect and direct" cooler. In the first stage, incoming air passed through a heat exchanger that can cool the air without adding moisture. In second stage, air passes through the water soaked pad where the temperature dropped more and air to be pick the water which is increasing the humidity. So, two stage evaporative cooling system is a smart cooling as considered as a cost factor and power saving.

Especially since cooling systems are becoming more popular resulting in increased demand of energy. Buildings with radial ceiling cooling systems, also known as "chilled Beam" systems, incorporate pipes in the ceiling through which chilled water flows. The pipes lie close to the ceiling surfaces, and they cool the room via natural convection and radiant heat transfer the demand of ventilation appliances in the residential and commercial buildings in the topical reason is increasing very rapidly due to the population increase as well as climate change. The increasing number of high rise buildings may result in lack of natural ventilation in modern building increases need of cooling. Generally fan and air conditioner are used to obtain cooling effect. After some time the cooling effect is increased above the comfort level causing shivering. While the use of radial cooling system it maintains comfort level of humans by reducing about 5-6 degree Celsius that of atmospheric temperature and also reduces the use of energy

Keywords:- Power saving, Humidity, chilled beam.

1. Introduction

Radiant cooling refers to any system where surrounding surface temperatures are lowered to remove sensible thermal loads from a conditioned space and its occupants, thus providing or contributing to thermal comfort. Radiant cooling uses actively cooled surfaces to absorb excess thermal energy and remove it from a space. This is the inverse of the radiant floor heating systems .In the case of radiant cooling thermal energy is flowing from the occupants, equipment, lights, and other surfaces in the room to the actively cooled surface. Active thermal slab systems, as the other radiant systems, belong to the so called Low Temperature Systems, they can heat and cool buildings with a little temperature difference between the supply fluid and indoor air. As a consequence, an increasingly use of renewable energy sources and a considerable energy saving can be realized

Principle of Operation:-It state that water is used as cooling medium with the help of pump water is passed through copper tubes present in the ceiling of model.

As water passes through tubes that will absorb the heat present inside the model and exits through outlet their byit reduces the temperature of confined space by 5-6 degree Celsius than that of atmospheric temperature.

2. OBJECTIVES

The main objective of the current study are analyzed to complete the project are

1. Study of suitable material for radial cooling model
2. Fabrication of radial cooling system
3. Analysis on performance of radial cooling system
4. Improving the performance of radial cooling system.

3. Materials andMethodology

Materials:-

Concrete bed, Water pump, tank, Thermocouple, Copper tube, Power source, Thermometer.

Methodology

Objectives

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Material selection

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Preparation of 3d model

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Analysis of model

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Conclusion

4. Experimental details

1. According to required dimensions model has prepared using suitable material and cooper tubes are placed in the ceiling.
2. Model is well insulated, thermocouple is fitted and connected to Digital temperature indicator.
3. Water at suitable temperature is passed through copper tubes with the help of motor and it is recirculated.
4. After some time temperature inside the model is checked with temperature gun and compared with atmospheric temperature.
5. Thermocouple readings are obtained from Digital temperature indicator.

5. Results and Discussion

1. Two models are prepared one is without radial cooling and other is with radial cooling.
2. These models are exposed to sunlight with proper orientation and observed changes in temperature with time.
3. Suitable temperature of water is passed as it passes through copper tubes water outlet temperature is increased 5-6 degree Celsius than water inlet temperature.
4. After certain time model inside temperature is reduced by 5-6 degree Celsius than that of atmospheric temperature.
5. Temperatures inside and outside the model are checked with temperature gun were recorded and compared.
6. Ceiling temperature of model were noted and plotted
7. Graphs plotted for different inlet temperatures as temperature v/s time.

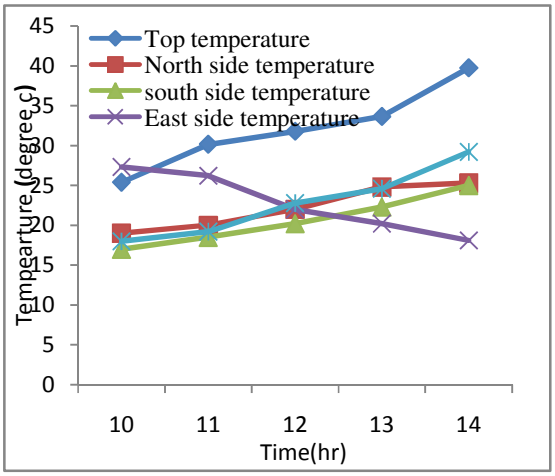

Figure:-Temperatures of system without radial cooling.

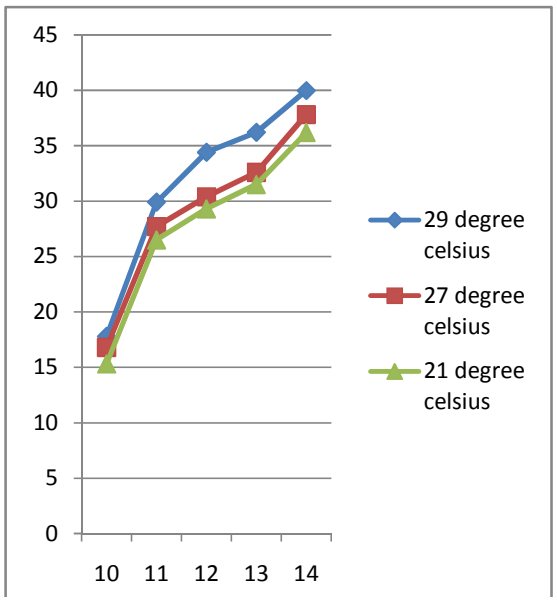

Figure:- Top ceiling temperatures comparison with various water cooling temperature.

Conclusions

1. We have fabricated the two model one with radial and other without radial cooling.
2. After passing inlet water through copper tubes model inside temperature is reduced by 5-6 degree Celsius than atmospheric temperature
3. Different range of water inlet temperatures are passed and observed their effect on cooling.
4. Copper tubes placed at ceiling will gives more cooling effect.
5. It is experimentally proved that using radial cooling system is more economical than conventional Air conditioner.

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