SMART TECHNOLOGY TO REDUCE INTERNAL ROOM TEMPERATURE (BY NATURAL AIR-CONDITIONER)

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Abstract:- Fly ash bricks, contrary to the popular belief, results in decreased room temperature. Red bricks actually increase the room temperature. Because of these reasons there is a chance of increased interior room temperature. There will be lots of money spent to control that. Our project aims to change that. We use an Eco- cooler which is simple in construction and are easy to install. It thus changes the temperature.

Key words: Temperature, Natural Air conditioner, Eco cooler, Continuity theorem.

Introduction

As a Civil Engineering methods that we use any thing should be effective in cost and so convenient to build in rural areas. So to imply a technique in India where population is high eco-system method will make an impact in society. Eco cooler is a method to cool down temperature with waste plastic materials available. Its origin started in Bangladesh where in rural areas even street lamp is rare. This kind of method change living nature in the society among them. It is nothing but a grid made from half cut out plastic bottles, which can be placed in windows. Hot air enters the open end of the bottle and gets compressed in the bottle's neck, making it cooler before it passes into the room. After initial tests, blueprints of the Eco-Cooler were put up online for everyone to download for free. Raw materials were easily available, therefore, making Eco-Coolers a cost-effective and environment-friendly solution.

The smart windows were hypothesized back in 1979 itself. First it was thought to do with liquid crystal. But it was not implemented. But twenty years later Innovative Glass Corporation in 2003, developed the market with the registered trademark of e-Glass. Today innovative glass is fully engaged and further research and development, marketing and distribution of electronically switchable glass product, along with the expanded dynamic glazing product line to dozens of industries and businesses throughout the world. The e-Glass product line is centered around solutions that provide privacy, heat, light and energy control.

Continuity Theorem

The product of cross sectional area of the pipe and also the fluid speed at any point along the pipe is constant which is equal to the volume flow per second or simply flow rate. Consider a fluid that flows through a pipe which is non uniform in size. The fluid containing particles move along the same lines in a steady flow. If we consider the flow for a short interval of time Δt, the fluid at the lower end of the pipe covers a distance x_1 with a velocity v_1, then

Distance covered by the fluid = $x_1 = v_1 \Delta t$

Let A1 be the area of cross section of the lower end then

Volume of fluid that flows through the pipe at the lower end $= V = A_1 x_1 = A_1 v_1 \Delta t$

If ρ is the density of fluid, then the mass of fluid contained in the shaded region of lower end of the pipe is:

$$m_1 = \text{Density} \times \text{volume} \quad m_1 = \rho_1 A_1 v_1 \Delta t \quad ——–(1)$$

Now the mass flux defined as the mass of the fluid per unit time passing through any cross section at lower end is:

$m_1/\Delta t = \rho_1 A_1 v_1$

Mass flux at lower end = $\rho_1 A_1 v_1$ ——–(2)

If the fluid moves with velocity v_2 through the upper end of pipe having cross sectional area A_2 in time Δt, then the mass flux at the upper end is given by:

m2/Δt = $\rho_2 A_2 v_2$

　Mass flux at upper end =$\rho_2 A_2 v_2$——–(3)

Since the flow is steady, so the density of the fluid between the lower and upper end of the pipe does not change with time. Thus the mass flux at the lower end must be equal to the mass flux at the upper end so:

　　　$\rho_1 A_1 v_1 = \rho_2 A_2 v_2$ ——–(4)

In more general form we can write:

ρ A v =constant

This relation describes the law of conservation of mass in fluid dynamics. If the fluid is in compressible, then density is constant for steady flow of in compressible fluid so

$\rho_1 = \rho_2$

Now equation (4) can be written as:

$A_1 v_1 = A_2 v_2$

In general:

A v = constant

If R is the volume flow rate then:

R = A v = constant

Apparatus and construction

　　　The apparatus consists of PVC boards and funnels, Raspberry pi minicomputer (with on or off Python program), linear actuator and a toggle device preferably a smartphone.First the PVC board was cut according to the size of opening in the window.The number of holes in one of the PVC boards is equal to the larger diameter of the funnel. The other board has holes of size equal to the smaller diameter of the funnel. The funnel is fitted in the holes in both sides. The outer side edges are sealed making it look like a panel. Along the column of the panel, a hollow cylindrical rod is fixed which is connected to a linear actuator. The hot air enters through the larger diameter side and cold air leaves through the smaller diameter side.

Details:

This section deals with the model shown. Real time application may vary.

- Mount board sheets – 52cm x 75cm
- Funnel

Outer diameter	=	15cm
Inner diameter	=	1.8cm
Length of the funnel	=	13.5cm
Distance from rim to the neck	=	9.5cm
Distance from neck to end portion	=	4cm

Simulation

　In this investigation it is used as trial and error method. First the system is managed to sort out causes of heat generation. Next, it should be identified a number of solutions. Then analysing the disadvantages of different solutions, the best solution was chosen. That best solution in case of this project is the use of eco coolers with thermo chromic smart windows.

Simulation Results

The simulation shows the following result. It indicated that the air which is coming at the side of smaller diameter is relatively cooler when compared to air at the side of larger diameter.
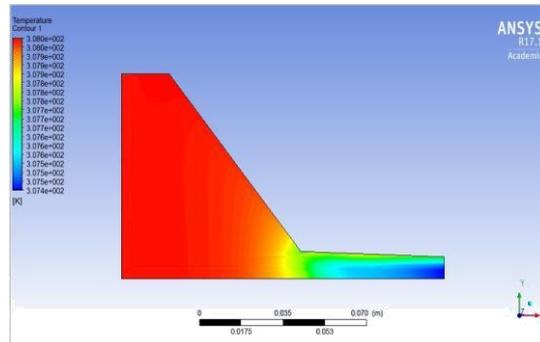

Fig. 1: Analysis of funnel using ANSYS software.

The simulation was done using Ogee type of nozzle. The following result is obtained.
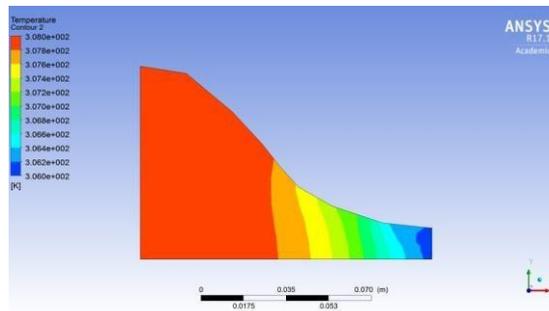

Fig. 2: Analysis of Ogee type nozzle.

Since the flow of air is subsonic, the outlet velocity is calculated using continuity equation,

$$A_1v_1 = A_2v_2$$

$$v_2 = (A_1v_1)/A_2$$

$$= [(p(0.15^2))/4] \times [4/(p(0.016^2))]$$

$$= 87.89 \times 3.33$$

$$= 292.67 \text{ m/s}$$

The pressure at the outlet is calculated using Bernoulli's equation,

$$(p_1/rg) + (v_1^2/2g) + z_1 = (p_2/rg) + (v_2^2/2g) + z_2$$

$$(101325/1.225g) + ((3.33^2)/2g) = (p_2/1.225g) + ((292.67^2)/2g)$$

[Since $z_1 = z_2 = 0$, Density of air = 1.225 kg/m^3]

$$p_2 = 48867.658 \text{ N/m}^2$$

The above inputs were given to the ANSYS software and simulation was done.

Results and Conclusions:

Based on this investigation it is observed that the Funnel Type system for windows can be reduced the internal room temperature around 3 ^{0}C to 4 ^{0}C. It is affordable and can be made home itself and is eco friendly and cost effective. Further it can be improved for large scale and diameter can be increased.

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