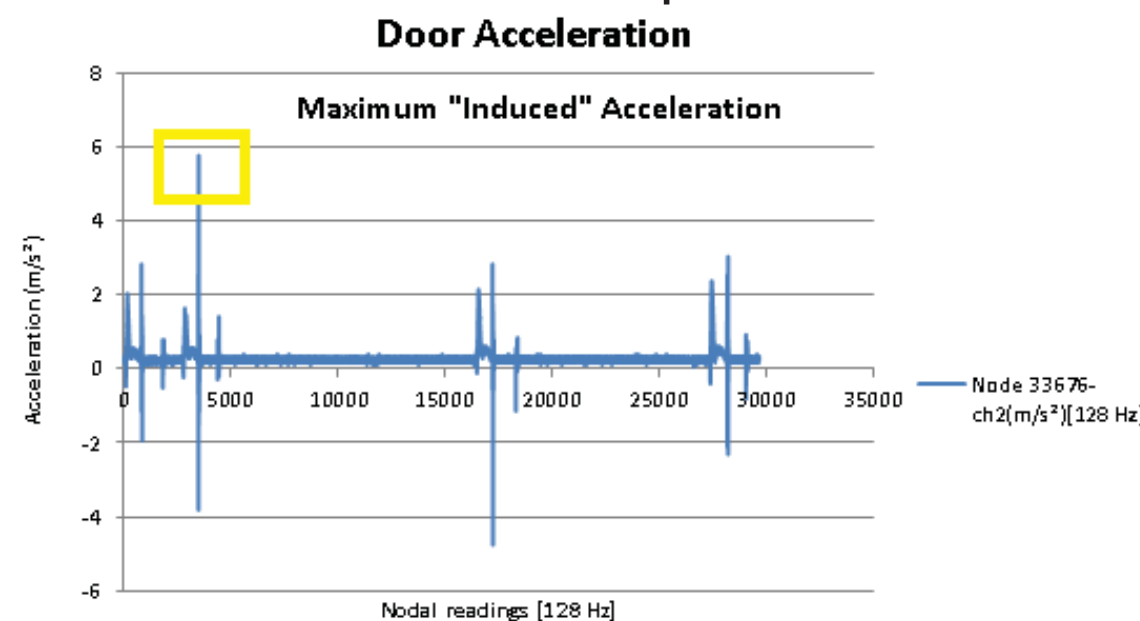


Motivation

- Unconscious force applied to hinged doors several times a day results in high potential of energy harvesting in doorways that see high traffic and frequent operation.
- Frequently opened door entry ways are a major source of energy loss and contaminated air conditions in buildings.
- Solution for private companies, particularly those with warehouses, is the use of electrical air curtains.

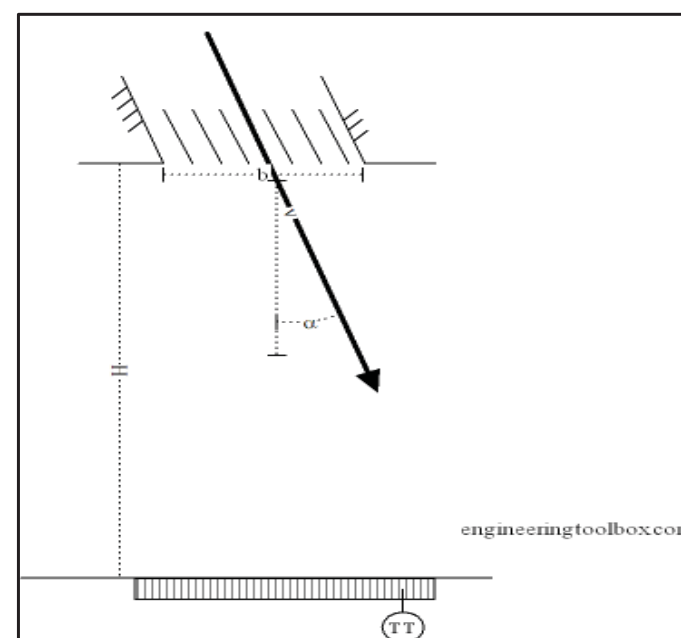
Design Requirement

- Accelerometer and Spring scale data of door opening operations were both taken and compared to calculate maximum force inputted.



$$Force = \frac{Moment}{Distance}$$

$$Force = mass \cdot acceleration$$



- BSRIA standards were followed for Air Curtain Design

$$\Delta p = \frac{2.2q^2 \sin(\alpha)}{bH^3}$$

$$D_m = \frac{b_o u_o^2}{gH^2 \left[\frac{T_o}{T_c} - \frac{T_o}{T_w} \right]}$$

Ideal Pressure Differential

Air velocity at head level

Conclusions & Further Development

- Potential for harvesting energy from hinged doors is substantial enough to create an adequate air curtain
- Future design: expand to electrical battery banks or implemented into standard door dampeners.

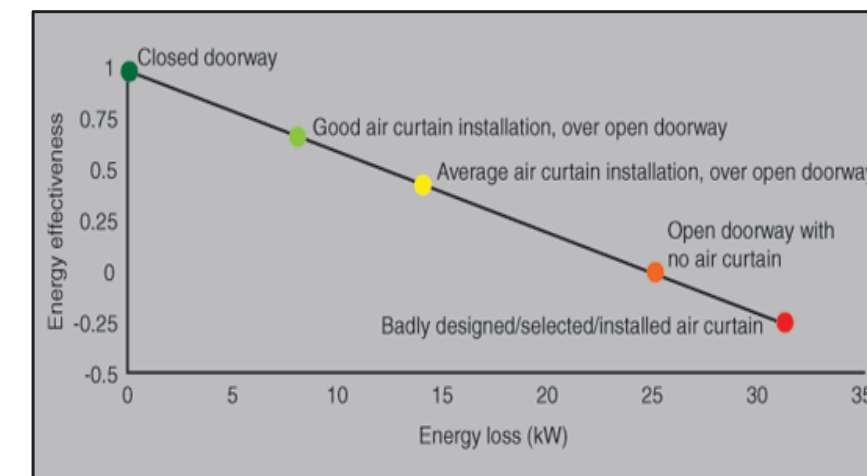


Future: Door Light Charger?

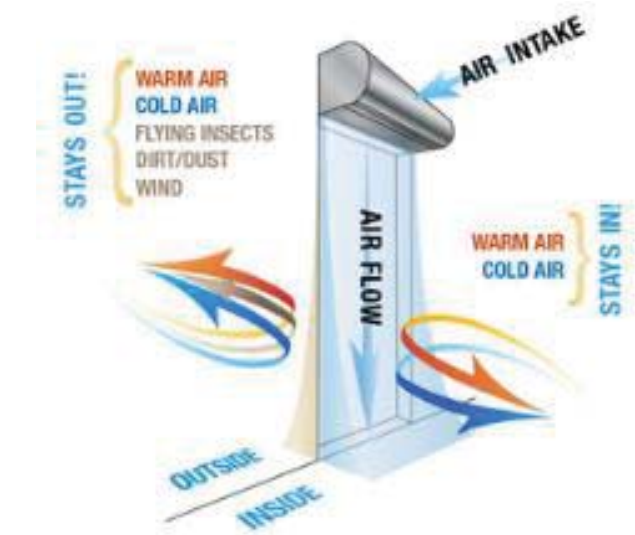
Undergraduate Research Award Funded Project

Objective

- Introduce an original design of air curtain which operates fans only when the door opens and closes through the conversion of door motion to fan rotation.
- Air stream created will prevent the transfer of outside air and contaminants.

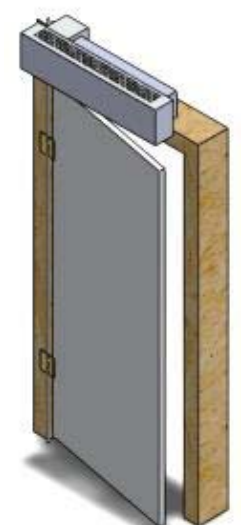


Energy Effectiveness Graph



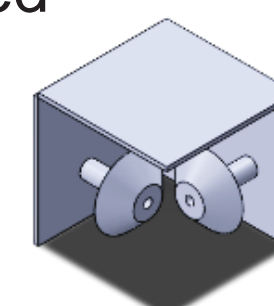
Air Curtain Functionality

Implementation



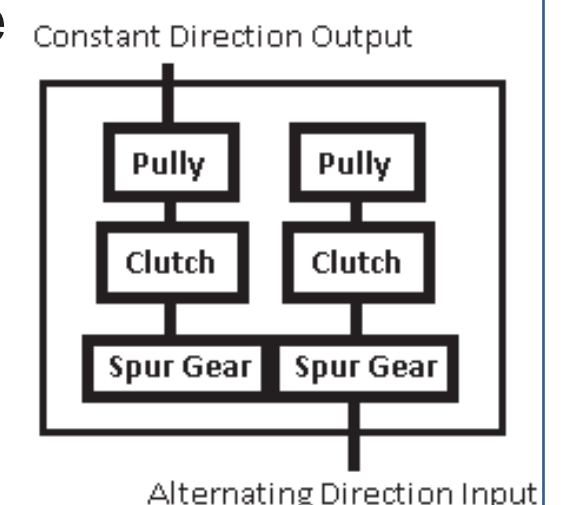
Gearbox

Producing the necessary **550 rpm** on the fan a **1:216** speed increasing gear box was developed



Clutch

To provide a constant flow of air it was decided to utilize both the opening and closing of the door through a modified parallel clutch design.



Sponsors for parts and materials:
Misumi & Tiny-Clutch

Mr. Hank Mink, Engineer Tech
Anderson Nunes De Sousa, Research Assistant