# Project Proposal

# Introduction

Commercial air travel is indeed the finest and fastest mode of transportation. In recent years, the number of persons who have travelled by commercial aeroplane has increased dramatically. Because an aeroplane travelling at high elevations is exposed to temperatures and pressures that are unsuited and dangerous to people, a pressurised and atmospheric control system is applied to protect passengers from the harsh environment. [1]

Heating, ventilation, and air conditioning (HVAC) refers to the overall system that controls and distributes air within a place. It has an impact on everything from room temperature and humidity to giving health advantages owing to enhanced air quality. The HVAC system in the aircraft can be based on the air cycle and vapour cycle. Monitoring system specializes in measuring flow in commercial HVAC systems. The flow controls the atmospheric conditions of the cabin of the aircraft.

# Problem definition

CFD analysis of HVAC (heating, ventilation and air conditioning) system related to flow monitoring in aircraft industries.

# Aims and objective

The objective of this work is to perform the CFD analysis of the HVAC (heating, ventilation and air conditioning) system related to flow monitoring in aircraft industries. To fulfil our objective we proposed following aims:

* Understanding of the HVAC system used in the aircrafts and selection of most suitable HVAC system.
* Calculation of different loads of the HVAC system and estimation of different flow of heat.
* Designing of the HVAC system for the aircraft.
* CFD modelling of the HVAC system to verify the proposed design.
* Comparison of the CFD analysis results with the real life conditions.

# Background information

When it comes to managing HVAC systems efficiently and affordably, the capable of monitoring volumetric flow rates & pressures within lines and rooms is critical. Pressure sensors are an important part of the system's control. Sensors with ever-increasing measurement ranges, increased detecting sensitively, accuracies, and long-term stability are necessary to assure compliance with severe regulatory standards and to decrease energy costs. When it comes to managing HVAC systems efficiently and affordably, the capable of monitoring volumetric flow rates and pressures in lines and rooms is critical. Pressure sensors are an important part of the system's control. [2]

Flow monitors, flow valves, and flow metres can be seen in the cooling panel and pumps of an HVAC system. As a passive cooling device, a cooling panel employs a heat pipe half filled with refrigerant. When the heat from the control panel passes through the tube's wall, it warms and vaporises the refrigerant, which helps chill the air. The HVAC system struggles to determine when it needs to switch on however much cooled (or heated) airflow it needs to force through to the ducts to bring the building to the proper temperature without a flow metre.

CFD simulations used to model alternative ventilation systems through several design iterations and examine their airflow distribution, saving a substantial amount of time and money spent on experimental research. CFD studies may also be used to investigate the impact of environmental characteristics like as velocity, temperature, and airborne pollutants within the aircraft cabin.

# Proposed methodology

Aircraft ventilation systems are critical not only for providing a constant supply of fresh air, but also for ensuring adequate air distribution and preventing airborne pathogen contamination. Passenger thermal environment is critical for a pleasant cabin atmosphere, hence measuring environmental characteristics like flow and thermal stratification for various ventilation systems is essential. When compared to a genuine cabin, experimental settings frequently lead to research uncertainties and limits of obtained data inside a mock-up model. This is owing to geometric or air supply system simplifications, and a thorough evaluation of airflow variances due to the simplifying assumptions should be considered. [3]

CFD models of aeroplane cabins can give a virtual answer for a physical phenomena (in this example, airflow monitoring of an airplane ventilation system), allowing for the study and comprehension of such simplifications while lowering the expense and time involved with experimental setups. CFD studies, on the other hand, need meticulous verification to ensure correctness. This study uses computational fluid dynamics to explore several aeroplane cabin ventilation systems and their effects on thermal comfort and pollutant movement in the cabin. Because there is no experimental inquiry to validate against, the CFD research outcomes are confirmed by performing a mesh sensitivity analysis.

# Project management

This object is based on the intense theoretical analysis. The modelling of the aircraft HVAC system for flow monitoring need many basic information as same as the real life scenarios. Hence initial work is study the different HVAC system implied in the different aircrafts. Based on the detailed analysis we would formulate some assumptions to perform our CFD analysis. The CAD model of the system is required for the CFD analysis. Hence, CAD model of aircraft cabin will be prepared using SOLIDWORK and CFD analysis will be performed using the ANSYS FLUENT. The software package are the essential to perform this work.

The safety standards of the HVAC system need to be maintained. In recent COVID pandemic, the HVAC system of the aircraft are the much responsible for spread of the SARS-CoV-2. [4] In restricted indoor areas, poor ventilation is linked to an increase in the spread of respiratory tract illnesses such influenza, TB, and rhinovirus infection. Similarly, SARS-CoV-2 transmission is more successful in tight areas, including from COVID-19 individuals who have not yet shown symptoms. [5]

The initial 3 weeks are required to study the different aircraft HVAC systems and the 5 weeks required for the modelling and after that 2 week required for the analysis.

# Summary

The objective of this work is to perform the CFD analysis of HVAC (heating, ventilation and air conditioning) system related to flow monitoring in aircraft industries. The aims to obtain the objectives discussed. The time- line required to complete this work is approximately 10 weeks. And mainly software resources are required to complete the project.

# Reference

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