Industrial Internship Report on

Drone Technologies

Prepared by

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Executive Summary
This report provides details of the Industrial Internship provided by upskill Campus and The IoT Academy in collaboration with Industrial Partner UniConverge Technologies Pvt Ltd (UCT). This internship was focused on a drone technologies. We had to finish the project including the report in 6 weeks' time. My project was learn about new technologies about drone and dynamic analysis of a wing. This internship gave me a very good opportunity to get exposure to Industrial problems and design/implement solution for that. It was an overall great experience to have this internship.

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1 Preface

Summary:

In the first week, the emphasis was placed on introducing the company, outlining its future prospects, and providing an overview of the organization's activities and ongoing projects. In the subsequent week, the content delved more deeply into the specific domain, offering comprehensive information and details related to that area.

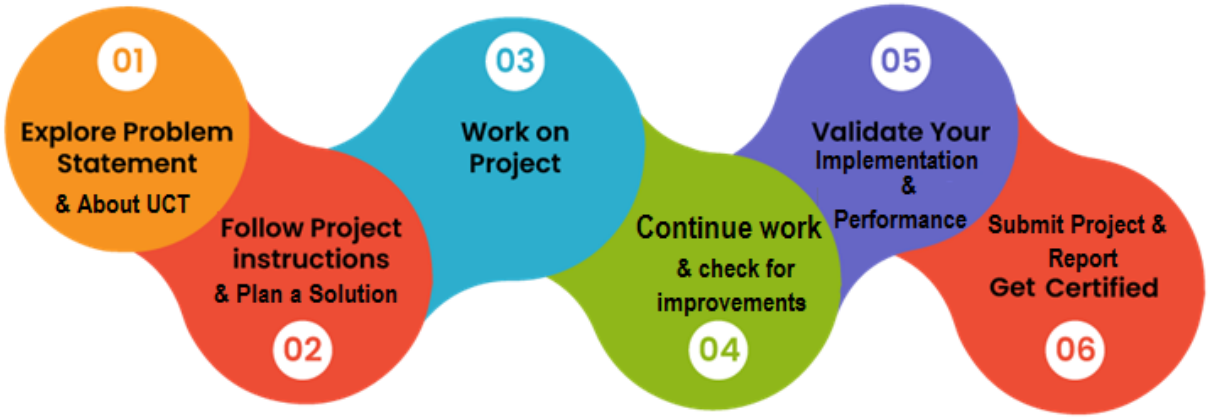
During this internship, I acquired knowledge about emerging drone technologies, current real-world technological trends, and future potential applications. It became evident that as both technology and human civilization continue to advance, drones are poised to play an increasingly significant role in shaping the future.

Through this internship, I've gained numerous knowledge-related benefits. They've allowed me to witness real-world applications of my field of study, keeping me updated on industry trends and refining my practical skills. Engaging in remote tasks has nurtured my ability to learn independently, build a portfolio of project experiences, and enhance my digital communication and collaboration proficiencies. These internships have opened doors for me to network with professionals globally, broaden my cross-disciplinary understanding, and prepare for virtual work settings. Additionally, I've developed cultural sensitivity, digital literacy, creative problem-solving aptitude, and a reflective learning approach. This internship have equipped me to navigate evolving work dynamics and furnished me with skills aligned with the contemporary job market requirements.

I acquired knowledge about emerging drone technologies, current real-world technological trends, and future potential applications. I have also learned the dynamic flow on the wing and how the flow of air affects the direction and lift the body.

I would like to express my heartfelt gratitude to the USC/UCT for providing me with the invaluable opportunity of participating in the internship program. This experience has enriched my understanding of the industry and allowed me to develop practical skills that will undoubtedly contribute to my professional growth. I am truly appreciative of the knowledge and insights I have gained during this internship.

How Program was planned



My Learnings and overall experience.

Participating in this internship has provided me with a valuable and transformative learning experience. Engaging in real-world projects and tasks has allowed me to apply the theoretical knowledge gained from my studies to practical situations. Collaborating with professionals in the field has not only deepened my understanding of industry practices but also exposed me to diverse perspectives and approaches. Overall, this internship has been instrumental in shaping my professional journey and equipping me with essential skills for future success.

Thanks to all Apurv sir, Kaushlendr sir and whole team who have helped you directly or indirectly.

2 Introduction

2.1 About UniConverge Technologies Pvt Ltd

A company established in 2013 and working in Digital Transformation domain and providing Industrial solutions with prime focus on sustainability and RoI.

For developing its products and solutions it is leveraging various **Cutting Edge Technologies e.g. Internet of Things (IoT), Cyber Security, Cloud computing (AWS, Azure), Machine Learning, Communication Technologies (4G/5G/LoRaWAN), Java Full Stack, Python, Front end** etc.

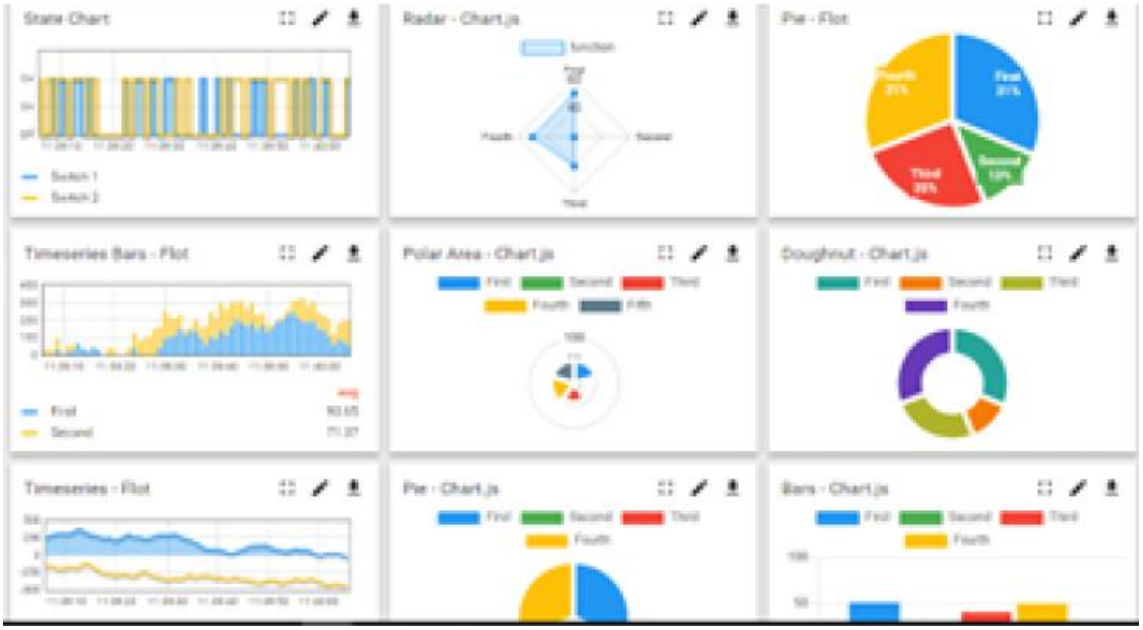
i. UCT IoT Platform (uct Insight)

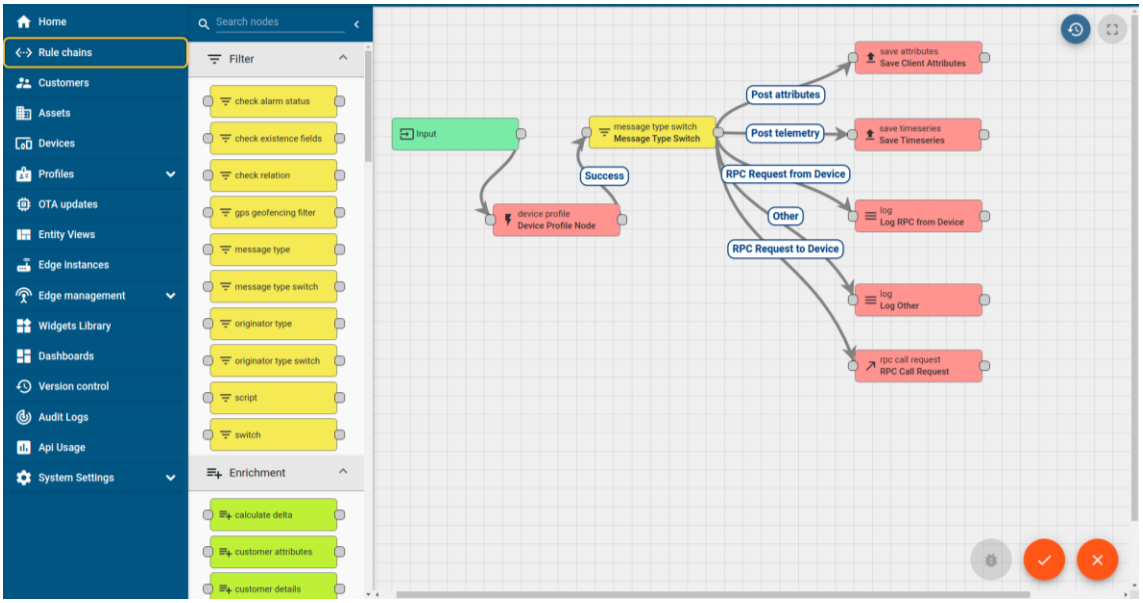
UCT Insight is an IOT platform designed for quick deployment of IOT applications on the same time providing valuable "insight" for your process/business. It has been built in Java for backend and ReactJS for Front end. It has support for MySQL and various NoSql Databases.

- It enables device connectivity via industry standard IoT protocols - MQTT, CoAP, HTTP, Modbus TCP, OPC UA
- It supports both cloud and on-premises deployments.

It has features to

- Build Your own dashboard
- Analytics and Reporting
- Alert and Notification
- Integration with third party application (Power BI, SAP, ERP)
- Rule Engine





ii. Smart Factory Platform (FACTORY WATCH)

Factory watch is a platform for smart factory needs.

It provides Users/ Factory

- With a scalable solution for their Production and asset monitoring
- OEE and predictive maintenance solution scaling up to digital twin for your assets.
- To unleased the true potential of the data that their machines are generating and helps to identify the KPIs and also improve them.
- A modular architecture that allows users to choose the service that they what to start and then can scale to more complex solutions as per their demands.

Its unique SaaS model helps users to save time, cost and money.

Machine	Operator	Work Order ID	Job ID	Job Performance	Job Progress		Output		Rejection	Time (mins)				Job Status	End Customer
					Start Time	End Time	Planned	Actual		Setup	Pred	Downtime	Idle		
CNC_S7_81	Operator 1	WO0405200001	4168	58%	10:30 AM		55	41	0	80	215	0	45	In Progress	i
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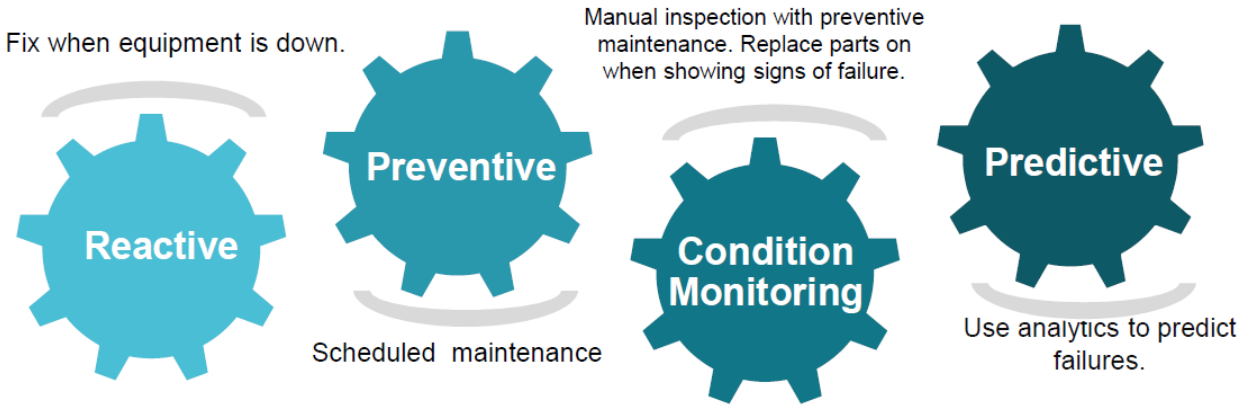
iii. LoRaWAN based Solution

UCT is one of the early adopters of Lora WAN technology and providing solution in Aggrotech, Smart cities, Industrial Monitoring, Smart Street Light, Smart Water/ Gas/ Electricity metering solutions etc.

iv. Predictive Maintenance

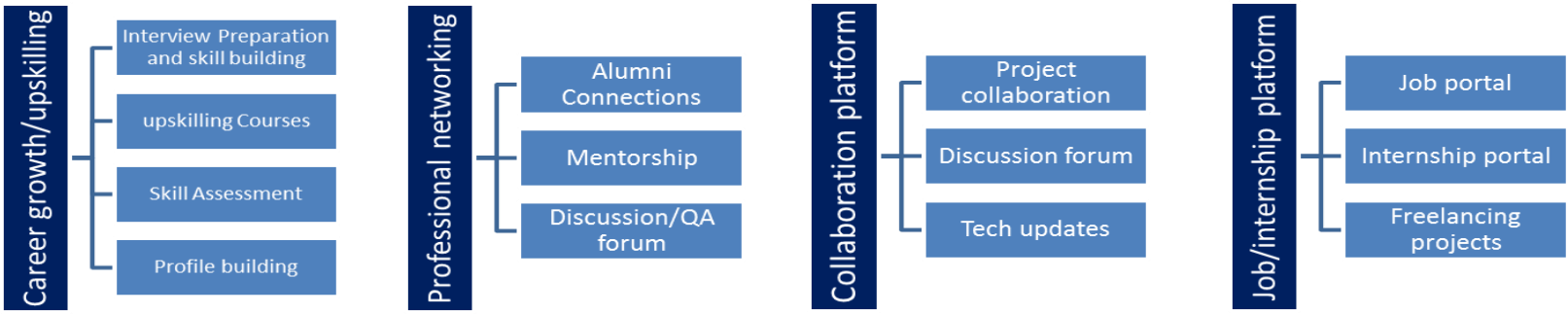
UCT is providing Industrial Machine health monitoring and Predictive maintenance solution leveraging embedded system, Industrial IoT and Machine Learning Technologies by finding remaining useful life time of various Machines used in production process.



2.2 About upskill Campus (USC)

Upskill Campus along with The IoT Academy and in association with Uniconverge technologies has facilitated the smooth execution of the complete internship process.

USC is a career development platform that delivers **personalized executive coaching** in a more affordable, scalable and measurable way.



2.3 The IoT Academy

The IoT academy is Edu Tech Division of UCT that is running long executive certification programs in collaboration with EICT Academy, IITK, IITR and IITG in multiple domains.

2.4 Objectives of this Internship program

The objective for this internship program was to

☛ Get practical experience of working in the industry.

☛To solve real world problems.

☛To have improved job prospects.

☛To have improved understanding of our field and its applications.

☛To have Personal growth like better communication and problem solving.

3 Problem Statement

To study the wing of an airplane

An airplane wing experiences several forces and aerodynamic principles that contribute to its flight. The primary forces acting on an airplane wing are lift, weight (gravity), thrust, and drag. These forces work together to enable controlled flight. Let's delve into each force in detail:

Lift:

Lift is the force that opposes gravity and keeps the airplane airborne. It is generated due to the shape of the wing and the relative motion of air over and under it. The wing's curved upper surface and flatter lower surface create a pressure difference: lower pressure on the top and higher pressure on the bottom. This pressure difference results in an upward force called lift. The Bernoulli's principle, which states that the pressure of a fluid decreases as its velocity increases, contributes to this effect. The angle of attack (the angle between the wing's chord line and the oncoming air) also affects lift. Increasing the angle of attack initially increases lift, but too much angle can lead to a stall, where lift decreases dramatically.

Weight (Gravity):

Weight is the force pulling the airplane downward due to gravity. It acts through the center of mass of the airplane. To achieve level flight, lift must be equal to weight. To climb, lift must exceed weight, and to descend, weight must exceed lift. Weight is a constant force and remains consistent throughout flight.

Thrust:

Thrust is the force that propels the airplane forward. It is produced by the engines, which expel a high-speed stream of gases backward, following Newton's third law of motion (action and reaction). Thrust counteracts drag and helps the airplane achieve and maintain its desired speed and altitude. Pilots control thrust to adjust the airplane's speed and direction.

Drag:

Drag is the resistance the airplane encounters as it moves through the air. It opposes the forward motion and is influenced by factors such as the airplane's shape, size, speed, and the air density. Different types of drag include:

Parasitic Drag: Caused by friction between the airplane's surface and the air, it includes form drag (air resistance due to the airplane's shape) and skin friction drag (frictional resistance on the airplane's surfaces).

Induced Drag: Generated as a result of the creation of lift. When air flows around the wing, some air spills over the wingtips, creating vortices. This vortex generation causes induced drag.

4 Existing and Proposed solution

The forces acting on an airplane wing, namely lift, weight, thrust, and drag, are influenced by various parameters that impact the aircraft's flight characteristics. Here's how different parameters affect these forces:

1. Angle of Attack (AoA):

Changing the angle of attack, which is the angle between the wing's chord line and the oncoming airflow, directly affects lift and drag. Increasing the angle of attack initially increases lift as more air flows over the wing's upper surface. However, if the angle becomes too steep, the airflow can separate from the wing's surface, causing a decrease in lift and an increase in drag. This condition is known as a stall.

2. Airspeed:

Airspeed, or the velocity of the airplane relative to the surrounding air, significantly affects lift and drag. Higher airspeed generally leads to more lift and more drag. An increase in airspeed increases the airflow over the wing, resulting in higher pressure below and lower pressure above the wing, leading to increased lift. However, higher airspeed also results in higher drag due to increased friction and air resistance.

3. Engine Thrust:

Engine thrust is a crucial factor in controlling the airplane's speed and altitude. Pilots adjust thrust to achieve the desired balance between lift and weight. Increasing thrust increases the airplane's speed and altitude, while reducing thrust results in decreased speed and altitude.

4. Air Density:

Air density, which varies with altitude and atmospheric conditions, directly affects lift and drag. Higher air density results in increased lift and drag, as there are more air molecules to generate lift and encounter drag. For example, flying at higher altitudes with lower air density requires higher airspeed for the same amount of lift.

5. Aircraft Configuration:

The aircraft's configuration, including the deployment of landing gear, flaps, and other control surfaces, affects both lift and drag. Flaps and slats are extended during takeoff and landing to increase lift and decrease stall speed. However, they also increase drag.

6. Weight and Center of Gravity:

Changes in the aircraft's weight distribution and center of gravity can affect its stability and maneuverability. Shifting the center of gravity forward or backward can influence the balance between lift and weight, impacting the airplane's pitch stability.

7. Wing Design and Shape:

The wing's design, including its shape, wing area, and wing aspect ratio, affects lift and drag. A longer wing with a higher aspect ratio generally generates more lift with less induced drag. The wing's camber and airfoil shape also influence lift and drag characteristics.

8. Altitude:

Flying at different altitudes impacts air density, which directly influences lift and drag. As aircraft climb to higher altitudes, air density decreases, requiring adjustments in thrust and airspeed to maintain the desired lift.

In summary, these parameters collectively interact to determine the balance between lift, weight, thrust, and drag, shaping an aircraft's performance, stability, and maneuverability during flight. Flight control systems, operated by pilots and sometimes assisted by automation, play a vital role in managing these forces and parameters for safe and efficient flight.

4.1 Code submission (Github link)

https://github.com/23Atharva?tab=repositories

4.2 Report submission (Github link)

5 Proposed Design/ Model

CFD Analysis of a Wing

Steps followed to do analysis of a wing:

Step1: Create a 3D model using solidworks**.**

Step2: While creating the curve for airfoil. I have obtained the input data from airfoil database.

Link: https://m-selig.ae.illinois.edu/ads/coord_database.html

Step3: Save the file in IGES format.

Step4: Import this file to Ansys Workbench.

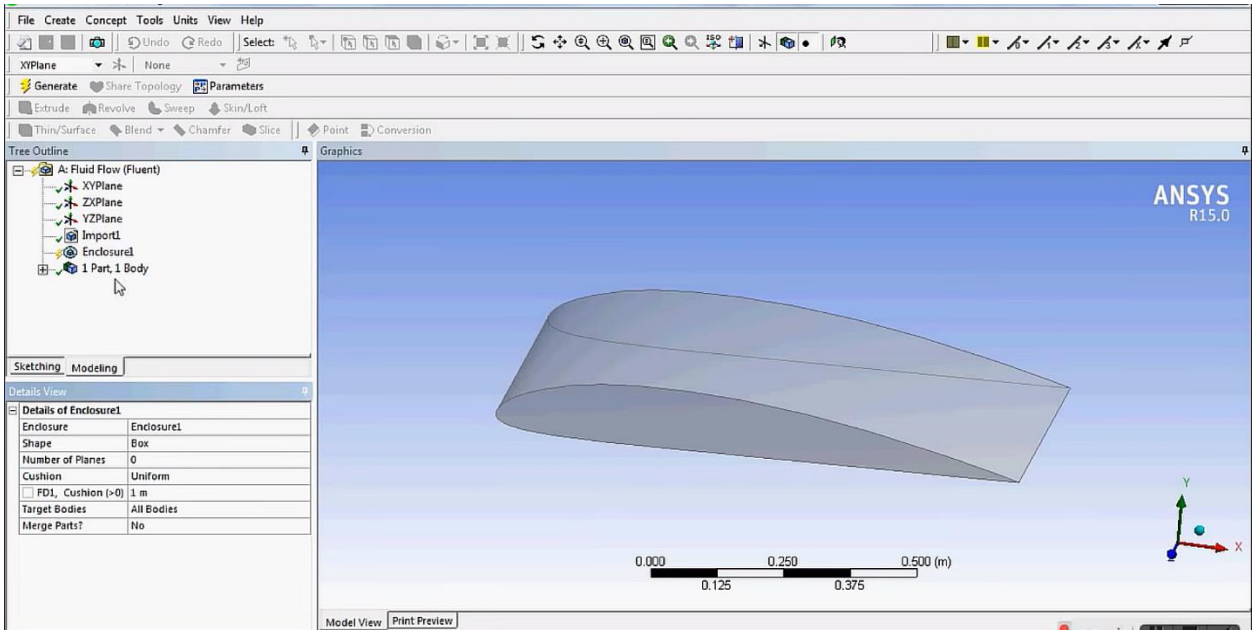


Fig1: Imported IGES file to workbench

Step5: Mesh the file/3D model.

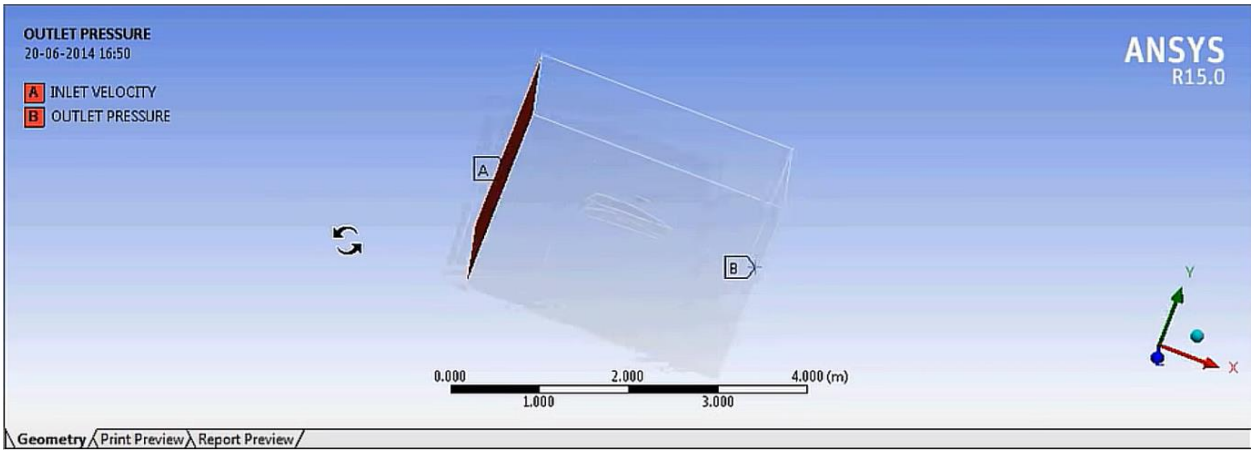


Fig2: Applied boundary condition

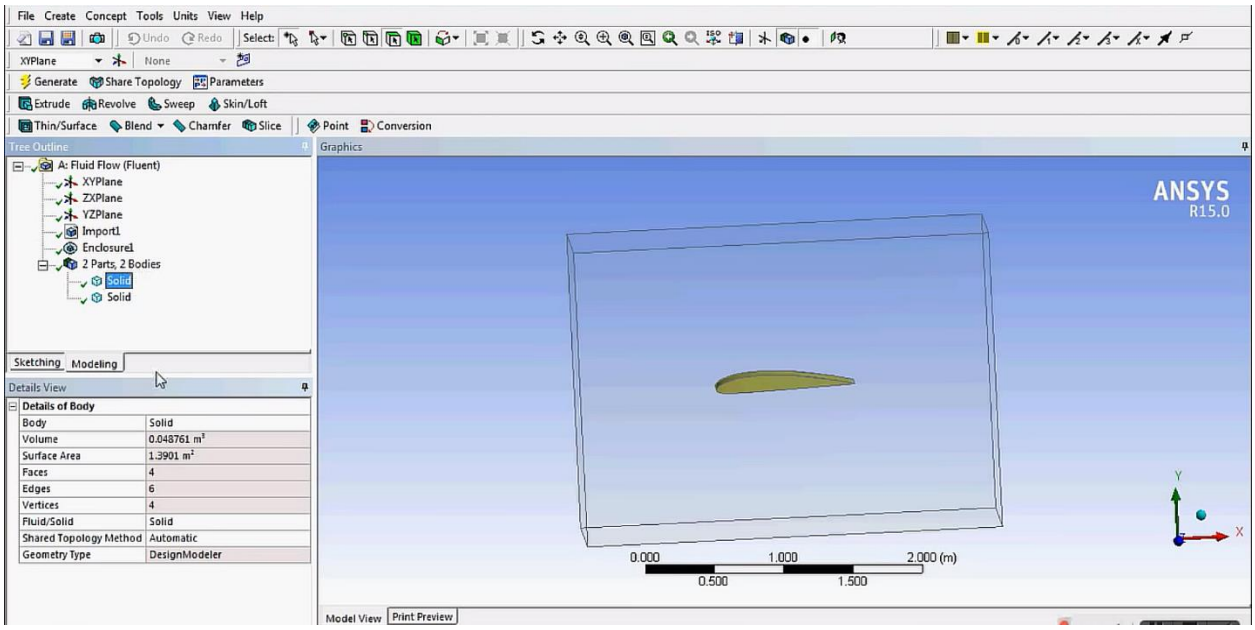


Fig3: Meshing conditions

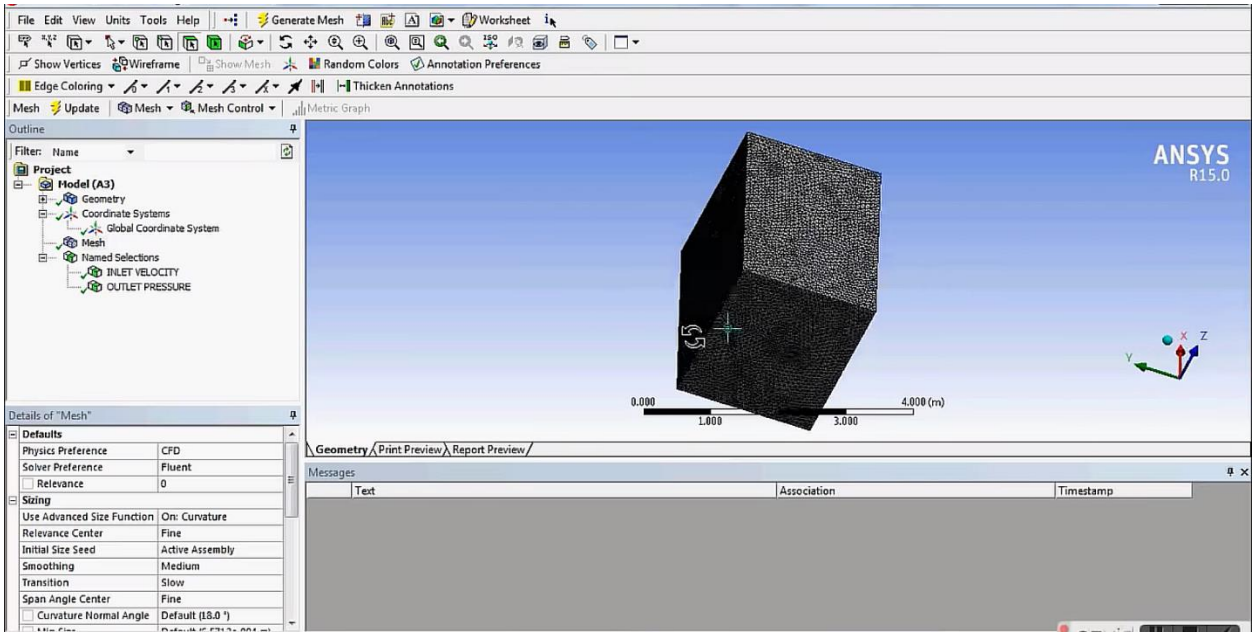


Fig4: Meshing

Step6: Start the fluent for Ansys.

Considering the velocity as 133m/s.

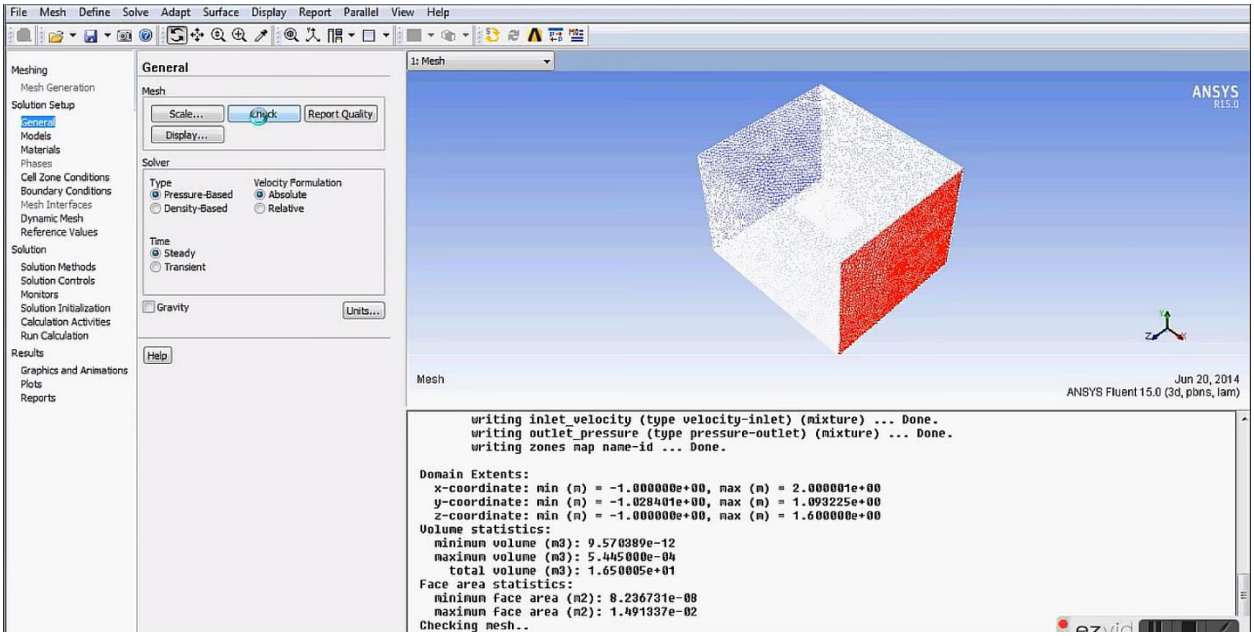


Fig5: Obtaining the solution

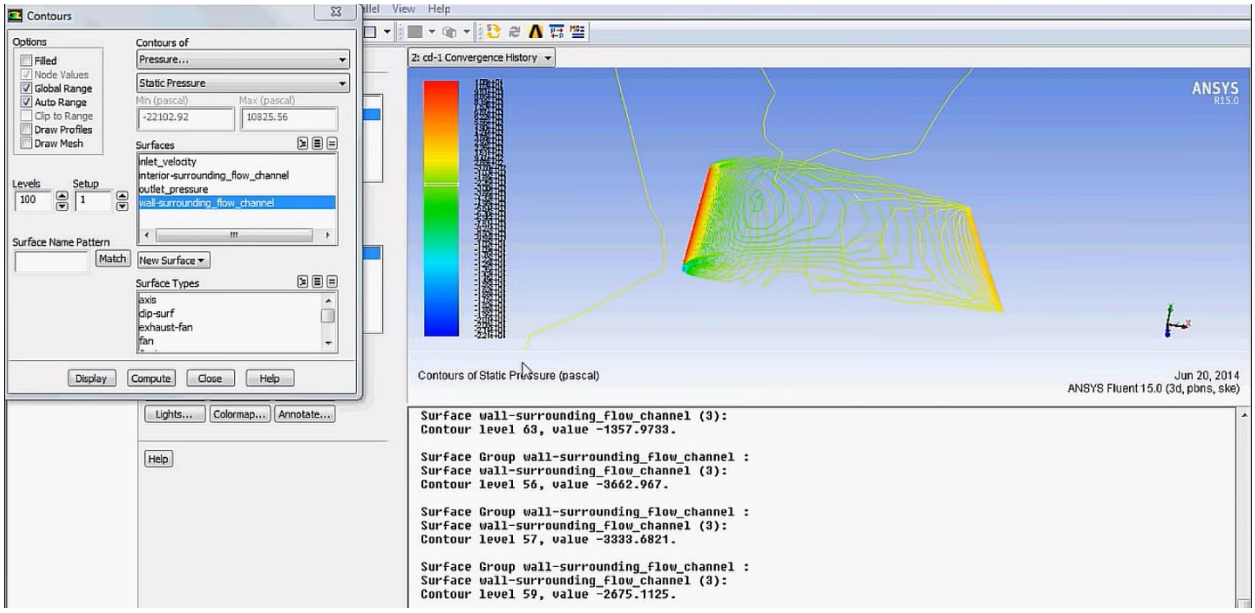


Fig6: Solution

Solution Obtained:

Drag along x direction=68.93N

Lift along Y direction= 111.76134N

Conclusion:

Since, the length of the wing is made shorter, we have obtained shorter lift.

6 My learnings

Participating in an online drone internship has been a transformative learning experience. Through this virtual platform, I've gained a comprehensive understanding of drone technologies and their diverse applications. I've learned how to operate and program drones remotely, acquiring practical skills in flight planning, navigation, and data collection. Collaborating with industry experts through online channels has provided me with insights into advanced drone operations like aerial mapping, 3D modeling, and environmental monitoring. I've developed problem-solving abilities by addressing challenges related to remote drone control, data analysis, and troubleshooting technical issues virtually. Additionally, I've

grasped the significance of adhering to regulations and ethical considerations in the use of drones, particularly in areas concerning privacy and airspace restrictions. This internship has not only expanded my technical proficiency but also illuminated the potential of drones to revolutionize sectors such as agriculture, disaster response, and infrastructure inspection. In sum, this online drone internship has equipped me with skills and knowledge that are crucial for my future endeavors in the rapidly evolving field of drone technology.

7 Future work scope

The future of drones holds tremendous promise across a range of industries and applications. As technology advances and regulations evolve, drones are poised to play an increasingly significant role in various sectors. Some key trends and potential developments in the future of drones include:

Delivery Services: Drones are likely to revolutionize last-mile delivery for packages, medicine, and even food, especially in remote or challenging-to-access areas. Companies are working on developing efficient and safe drone delivery networks.

Agriculture: Drones equipped with sensors and cameras can monitor crops, assess soil health, and apply precision agriculture techniques, leading to improved yield, reduced resource usage, and sustainable farming practices.

Environmental Monitoring: Drones can be used to monitor environmental changes, track wildlife, assess deforestation, and gather data on climate patterns, aiding in conservation efforts and disaster response.

Infrastructure Inspection: Drones are well-suited for inspecting bridges, power lines, pipelines, and other critical infrastructure, reducing the need for risky manual inspections and improving maintenance efficiency.

Search and Rescue: Drones equipped with thermal cameras and other sensors can assist in search and rescue operations, locating missing persons or disaster survivors in difficult-to-reach locations.

Film and Photography: Drones have transformed the film and photography industry, providing filmmakers and photographers with unique aerial perspectives and dynamic shots.

Mapping and Surveying: Drones can quickly and accurately map landscapes, construction sites, and urban areas, enhancing surveying efficiency and data accuracy.

Scientific Research: Drones are increasingly used in scientific research, enabling data collection in challenging environments, such as studying wildlife behavior, glacial melting, or volcanic activity.

Urban Air Mobility (UAM): The concept of flying taxis and urban air mobility is becoming more feasible with advancements in drone technology. These aerial vehicles could alleviate urban traffic congestion.

Connectivity and Communication: Drones could play a role in providing internet coverage to remote or underserved areas, acting as flying cell towers.

Disaster Response: Drones can rapidly assess disaster-affected areas, helping emergency responders assess damage and plan their interventions more effectively.

Healthcare: Drones might transport medical supplies, including vaccines and medicines, to remote or disaster-stricken locations, improving access to critical healthcare resources.

AI and Automation: Drones are becoming more autonomous and capable of making decisions in real-time using artificial intelligence algorithms, which will enhance their functionality and safety.

Regulations and Airspace Management: As drone adoption increases, regulations and technology for managing drone traffic will continue to evolve to ensure safe and efficient integration into airspace.

The future of drones is dynamic and full of potential, driven by ongoing technological advancements, innovative applications, and collaborative efforts from various industries and regulatory bodies.