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CHAPTER - 1

INTRODUCTION

1.1 Project overview

Machine learning is transforming the global business environment. Data is now the most valuable asset for enterprises in every industry. Companies are using data-driven insights for competitive advantage. With that, the adoption of machine learning-based data analytics is rapidly taking hold across various industries, producing autonomous systems that support human decision-making. This work explored the application of machine learning to aircraft engine conceptual design. Supervised machine-learning algorithms for regression and classification were employed to study patterns in an existing, open-source database of production and research turbofan engines, and resulting in predictive analytics for use in predicting performance of new turbofan designs.Specifically, the author developed machine learning-based analytics to predict cruise thrust specific fuel consumption and core sizes of high-efficiency turbofan engines, using engine design parameters as the input.The promising results of the predictive analytics show that machine-learning techniques merit further exploration for application in aircraft engine conceptual design. The capacity of machinery working cannot last forever, sometimes it will be broken-down because of out-dated operation. Machinery systems that include sensors are just monitoring the state of the machine, but cannot make a report of the machine in good or bad condition. To avoid the worst event (failure) and to get information about the status of a machine, maintenance strategy must apply on the machinery system that is scheduled.

1.2 PURPOSE

Engine failure is highly risky and needs a lot of time for repair. Unexpected failure leads to loss of money and time. Predicting the failure prior will save time, effort, money and sometimes even lives. The failure can be detected by installing the sensors and keeping a track of the values. The failure detection and predictive maintenance can be for any device, out of which we will be dealing with the engine failure for a threshold number of days.

The project aims to predict the failure of an engine by Machine Learning to save loss of time & money thus improving productivity.

CHAPTER-2

LITERATURE SURVEY

2.1 EXISTING PROBLEM

To gain a better understanding of aircraft maintenance costs, the owner of an airplane needs to consider a few necessary factors, including how they utilize their planes, where they base their aircraft, and usual flying routes. Proficient aircraft owners have good insight into potential problem areas present in their specific airplane type. They also take adequate measures to help safeguard crucial components and increase their useful lifespan. Different planes have diverse kinds of problem areas, and your selected aviation experts need to be well-experienced in a particular aircraft type in order to be an effective maintenance operation. Aircraft maintenance is the performance of tasks required to ensure the continuing of an aircraft or aircraft part, including overhaul, inspection, replacement, defect rectification, and the embodiment of modifications, compliance with airworthiness directives and repair.Airframe heavy maintenance and modification, Engine Maintenance, Line Maintenance, and Component maintenance. Heavy maintenance is performed less often, but requires a much more thorough breakdown, repair, or replacement of aircraft components and requires a large, well-equipped facility. Shop maintenance focuses on repair or overhaul of specific parts and often requires specialist services. Program is a document which describes the specific maintenance tasks and their frequency of completion, necessary for the continued safe operation of those aircraft to which it applies.

2.2 BIBLIOGRAPHY

1.Machine Learning-Based PredictiveAnalytics for Aircraft Engine Conceptual Design. (Michale T.Tong)

This work explored the application of machine learning to aircraft engine conceptual design. Supervised machine-learning algorithms for regression and classification were employed to study patterns in an existing, open-source database of production and research turbofan engines, and resulting in predictive analytics for use in predicting performance of new turbofan designs.

2.Approach And Landing Aircraft on-board Parameters Estimation with LSTM Networks. (Gabriel Jarry)

This addresses the problem of estimating aircraft on-board parameters using ground surveillance available parameters. The proposed methodology consists in training supervised Neural Networks with Flight Data Records to estimate target parameters.

3.Monitoring Of Aircraft Operation Using Statistics and Machine Learning. (Fazel Famili)

The purpose of this research is to develop methods that can be used to generate reliable and timely alerts so that engineers and fleet specialists become aware of abnormal situations in the large fleet of commercial aircraft that they manage.

4.Aircraft Engine Reliability Analysis Using Machine Learning Algorithms. (Deepnkar Singh)

The reliability analysis is also important to predict their scheduled maintenance event and the Remaining Useful Life (RUL) of engine parts. Existing approaches for engine reliability are based on numerical methods,which do not predict RUL accurately.

5.Predictive Maintenance and Performance Optimisation in Aircrafts using Data Analytics. (Sylvain Letourneau)

Airline industry has provided a significantly conventional, faster and reliable mode of transportation for passengers and freight over the decades in which the industry has been in service despite the pressure being applied especially in maintaining operational affordability.

2.3 PROBLEM STATEMENT DEFINITION

While safety and performance are the primary goals of aircraft maintenance, an effective maintenance program also maximizes the owner's resale value of the aircraft and prevents losses due to downtime.

Aircraft maintenance is intended to keep the aircraft in a state which will or has enabled a certificate of release to service to be issued. A hangar environment may be available but is often not necessary.

Problem Statement (PS)	I am (Customer)	I'm trying to	But	Because	Which makes me feel
PS-1	**Businessman**	**To reach the destination on time.**	**Not able to reach**	**Mechanical failure is another leading cause of accidents.**	**Stressed**
PS-2	**Tourist**	**To check the status.**	**No clear information**	**Airline Disasters crashes is not predicted correctly.**	**Frustrated**
PS-3	**Traveler**	**To Reach the path without any Obstacles.**	**Delay is occurred**	**Jamming the wheels.**	**Dissatisfied**

Figure 2.1 Problem Statement

CHAPTER-3

IDEATION AND PROPOSED SOLUTION

3.1 Empathy Map Canvas

An empathy map is a simple, easy-to-digest visual that captures knowledge about a user's behaviors and attitudes. It is a useful tool to help teams better understand their users. Creating an effective solution requires understanding the true problem and the person who is experiencing it. The exercise of creating the map helps participants consider things from the user's perspective along with his or her goals and challenges.

Figure 3.1 Empathy Map

3.2 IDEATION AND BRAINSTORMING

Brainstorming provides a free and open environment that encourages everyone within a team to participate in the creative thinking process that leads to problem-solving. Prioritizing volume over value, out-of-the-box ideas are welcome and built upon, and all participants are encouraged to collaborate, helping each other develop a rich number of creative solutions.

Step-1: Team Gathering, Collaboration and Select the Problem Statement

This step includes the formation of a team, collaborating with the team by collecting the problems of the domain we have taken and consolidating the collected information into a single problem statement.

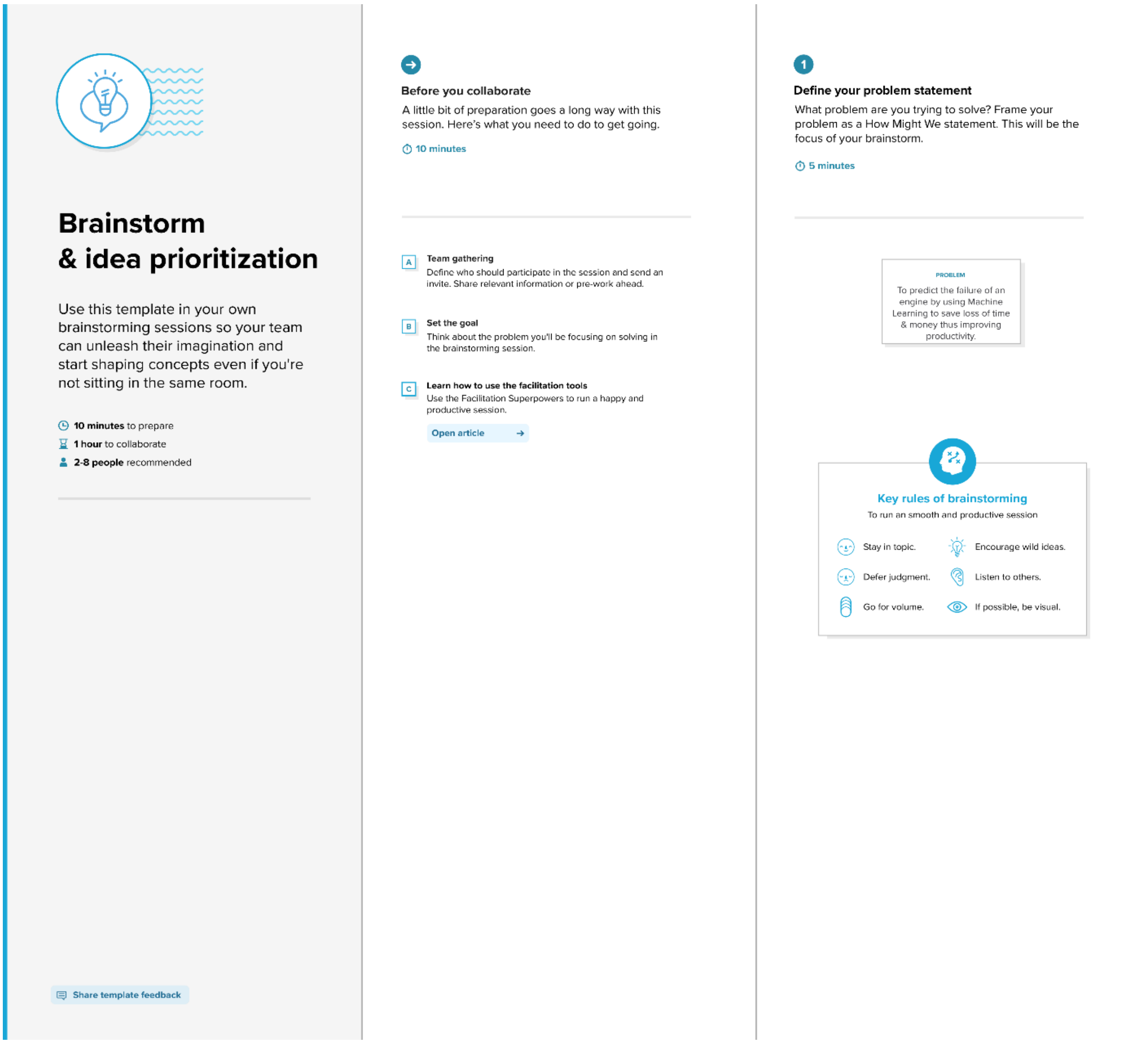


Figure 3.2 Ideation and Estimation

Step 2: Brainstorm, Idea Listing and Grouping

This step of ideation includes the listing of individual ideas by teammates to help with the problem statement framed. All the individual ideas have been valued and made individual clusters.

Then discussed as a team and finally made an idea Cluster A and concluded with the most voted ideas from all the clusters together and Cluster B with the least needed ideas.

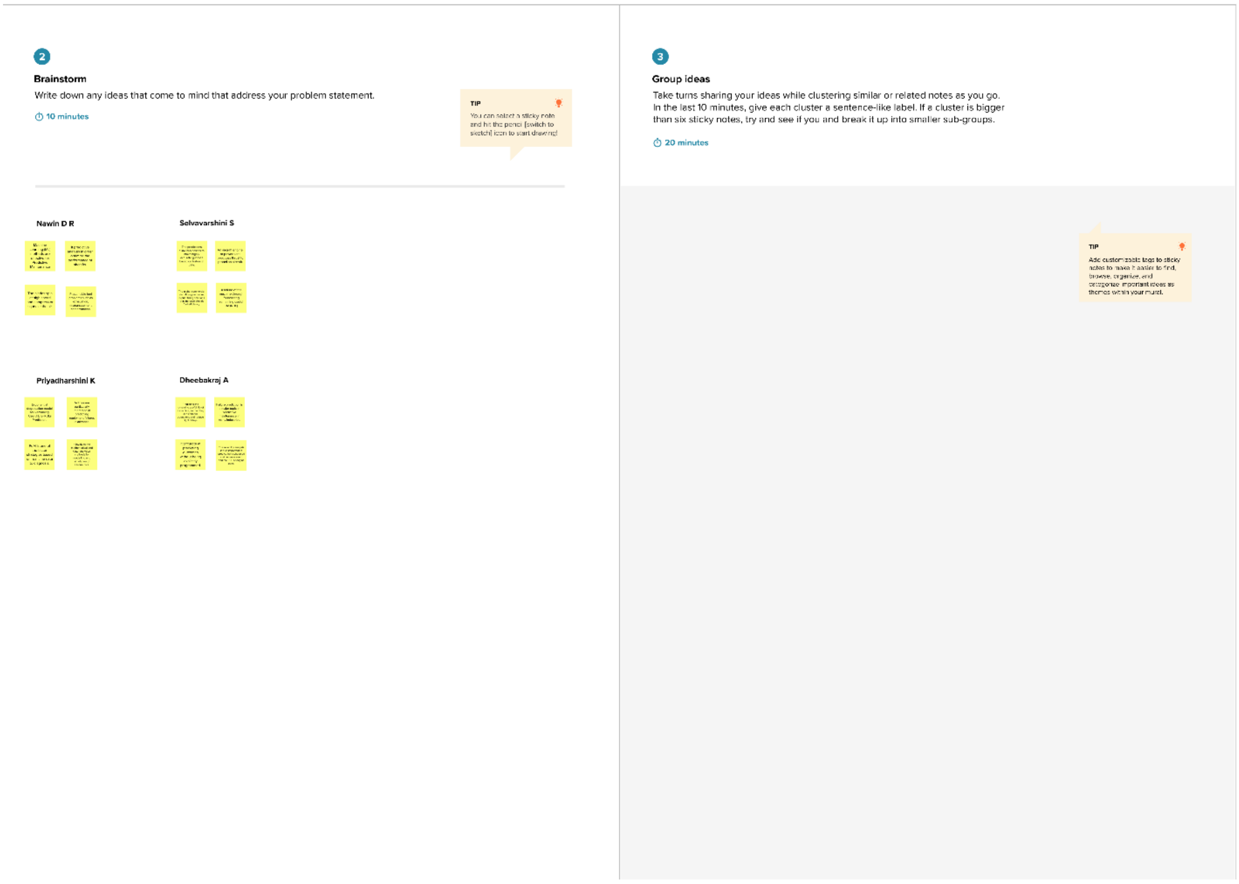


Figure 3.3 Brainstorm, Ides Listing and Grouping

Step 3: Idea Prioritization

This step includes the process of listing necessary components to come up with the working solution and making a hierarchy chart by prioritizing the components based on importance, say from the higher being backend and lower being the user interfacing components.

Figure 3.4 Idea Prioritization

3.3 PROPOSED SOLUTION

Problem Statement (Problem to be solved)

The project aims to predict the failure of an engine by Machine Learning to save loss of time & money thus improving productivity.

Idea / Solution description

Machine learning (ML) is a type of artificial intelligence (AI) that allows software applications to become more accurate at predicting outcomes without being explicitly programmed to do so. Structural failures where a broken connecting rod, crank, valve, or camshaft is present account for seventeen percent of engine failures.

Novelty / Uniqueness

An aircraft engine is a propulsion system for an aircraft. The Aircraft engine is the key module or the heart in aviation progress. Emissions from flight stay in the atmosphere and warm it for several centuries. Because aircraft emissions are high in the atmosphere.

Social Impact / Customer Satisfaction

An aircraft engine is a propulsion system for an aircraft. The Aircraft engine is the key module or the heart in aviation progress. Emissions from flight stay in the atmosphere and warm it for several centuries.

Business Model Revenue Model

Machine Learning model predictions allow business to make highly accurate guesses as to like the outcome of a question based on historical data.

Scalability of the Solution:

Preventable fuel problems such as exhaustion, mismanagement, contamination, or misfuelling.

3.4 Problem Solution Fit

The Problem-Solution Fit simply means that you have found a problem with your customer and that the solution you have realized for it solves the customer's problem. It helps entrepreneurs, marketers and corporate innovators identify behavioral patterns and recognize what would work and why.

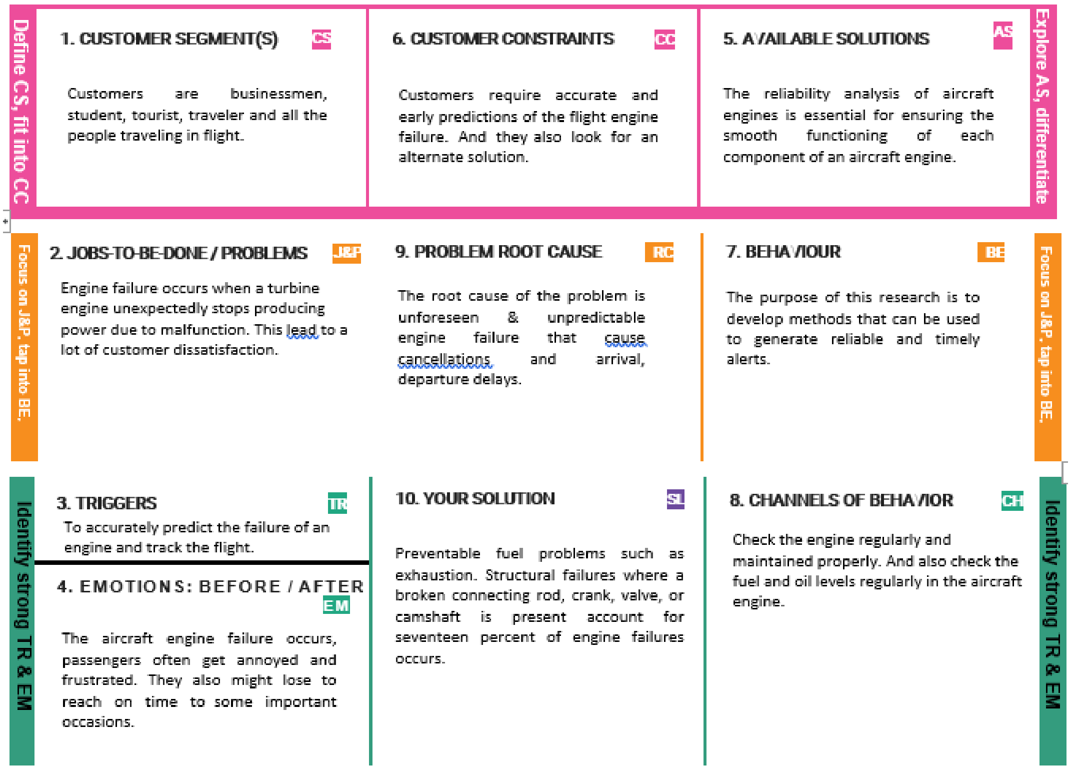


Figure 3.5 Solution Fit

CHAPTER-4

REQUIREMENTS ANALYSIS

4.1 Functional requirement:

FR-1	User Registration	Registration through form Registration through Gmail Registration through Phone number
FR-2	User Confirmation	Confirmation via mail Confirmation via OTP
FR-3	User Login	Login using Credentials
FR-4	Search	Get the aircraft engine details
FR-5	GPS	Track the mal-function in aircraft engine
FR-6	Analysis	Fetch Dataset
FR-7	Prediction	It will predict the aircraft engine failure and solve the problem

4.2 Non-Functional Requirements:

FR No	Non-Functional Requirement	Description
NFR-1	**Usability**	It indicates how effectively and easy users can learn and use a system.
NFR-2	**Security**	Assures all data inside the system or its part will be protected against malware attacks or unauthorized access.
NFR-3	**Reliability**	Specifies the probability of the software performing without failure for a specific number of uses or amount of time.
NFR-4	**Performance**	It deals with the measure of the system response time under different load conditions.
NFR-5	**Availability**	The system is accessible for a user at a given point in time.
NFR-6	**Scalability**	Assesses the highest workloads under which the system will still meet the performance requirements.

CHAPTER-5

PROJECT DESIGN

5.1 Data Flow Diagrams:

The Data flow is the process to identify the path of the solution.

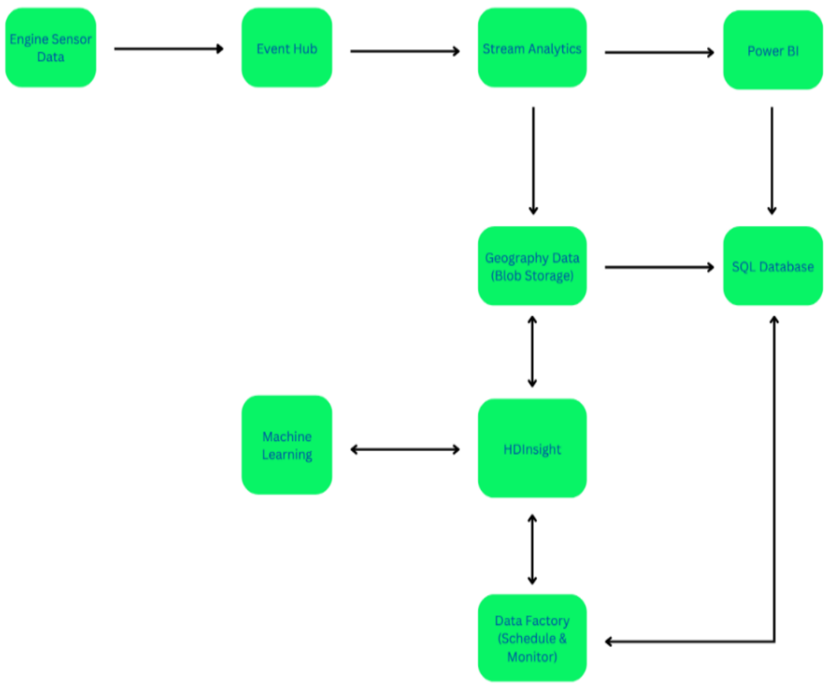


Figure 5.1 Data Flow Diagram

5.2 Solution and Technical Architecture:

The solution architecture includes the components and the flow we have designed to deliver the solution.

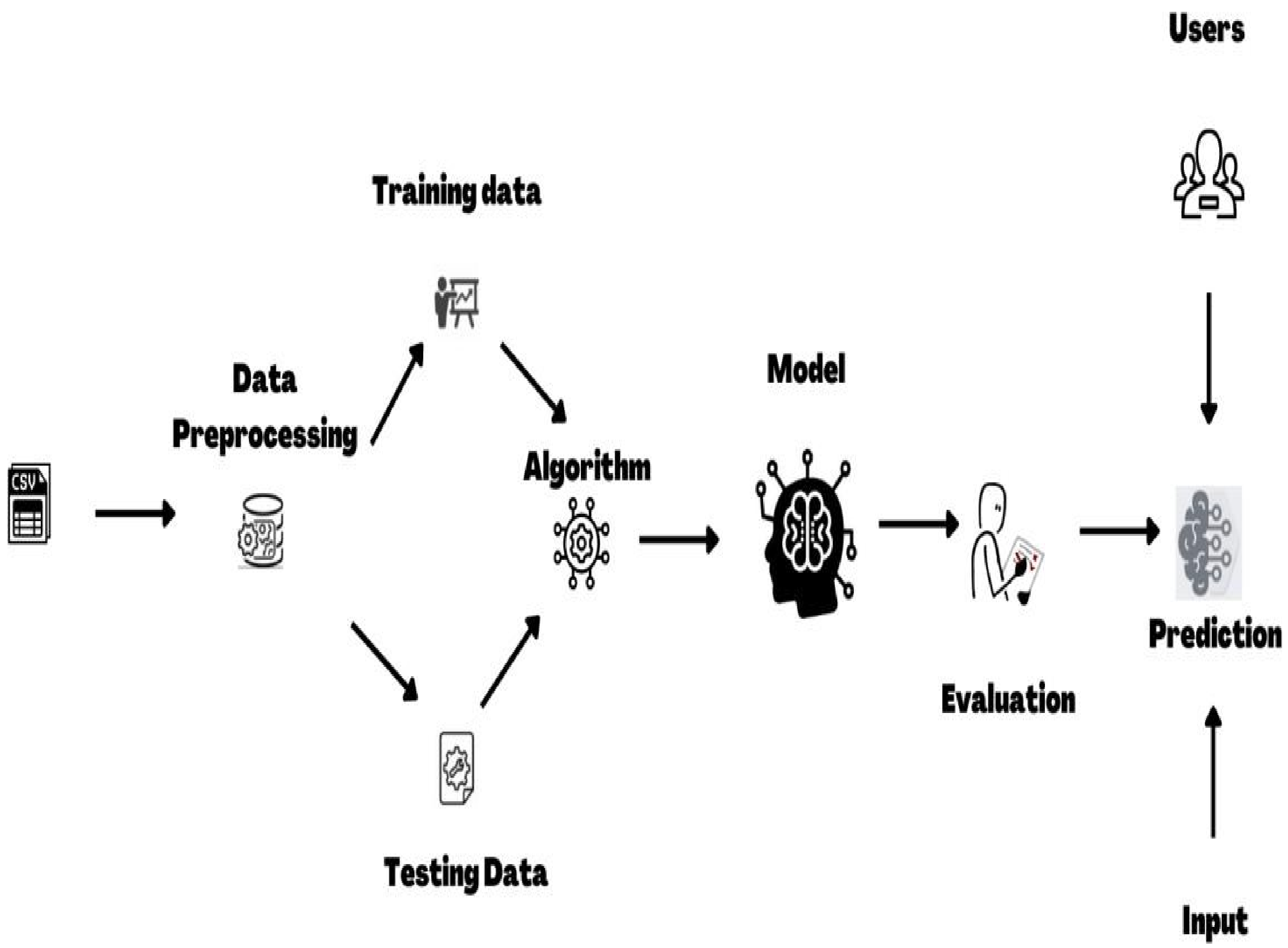


Figure 5.2 Solution and Technical Architecture

5.3 User Stories:

User Type	Functional Requirement (Epic)	User StoryNumber	User Story / Task	Acceptance criteria	Priority	Release
Customer (Web user)	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	I can access my account / dashboard.	High	Sprint-1
		USN-2	As a user, I will receive confirmation email once I have registered for the application.	I can receive confirmation email & click confirm.	High	Sprint-1
		USN-3	As a user, I can register for the application through Facebook, Instagram, other social Media.	I can register & access the dashboard with Facebook/Instagram Login.	Low	Sprint-2
		USN-4	As a user, I can register for the application through Gmail.	I can register and access the dashboard.	Medium	Sprint-1
	Login	USN-5	As a user, I can log into the application by entering email & password.	I can access the dashboard.	High	Sprint-1

	Dashboard	USN-6	As a user, I can navigate through different pages using the dashboard.	I can access various parts.	High	Sprint-1
	Search	USN-7	As a user, I can search for flights for different locations with proper engine condition.	I can receive information on different aircraft for various locations.	High	Sprint-2
	View	USN-8	As a user, I can view the details of aircraft engine.	I will get the information for the customer verification.	High	Sprint-2
	Receive Notifications	USN-9	As a user, I will receive notifications about the malfunction in aircraft engine.	I will get frequent updates oft the aircraft.	Medium	Sprint-3
	Track	USN-10	As a user, I can track the location of the aircraft.	I can track my aircraft.	Medium	Sprint-3,4
Administrator	GPS	USN-11	As an admin, I will need the location of aircraft.	I can track my aircraft.	High	Sprint-3,4
	Analyze	USN-12	As an admin, I will analyze the given dataset	I can analyze the dataset.	High	Sprint-2
	Predict	USN-13	As an admin, I will predict the aircraft engine failure.	I can predict the Aircraft engine condition.	High	Sprint-2

CHAPTER-6

PROJECT PLANNING AND SCHEDULING

6.1 Sprint Planning & Estimation

SPRINT 1

A registration form is a list of fields that a user will input data into and submit to a company or individual. There are many reasons why you would want a person to fill out a registration form. Companies use registration forms to sign up customers for subscriptions, services, or other programs or plans. Registration materials means the evidences of motor vehicle registration, including all registration cards, license plates, temporary permits, and nonresident temporary permits. Each field is made up of a control (the input) and its associated label. Registration form with four fields: first name, last name, email address, and password. Labels are where our discussion begins.

SPRINT 2

Login forms are used in almost every website and Application. A login form utilizes the credentials of a user, in order to authenticate their access. It generally consists of the typical username or email and password. But more fields can be added to improve the site's security. Login credentials authenticate a user when logging into an online account over the Internet. At the very least, the credentials are username and password; however, a physical or human biometric element may also be required. Login Dialog is a popup window that displays Login page content and can be dismissed by the user. Especially used to refresh the membership or for additional confirmation. The events that can be set include onSuccess, onError and onClose.

SPRINT 3

It is crucial that Aircraft Engines should undergo proper maintenance. Doing routine maintenance can be very expensive. Predictive maintenance is an effective alternative to it. This approach ensures cost saving. It is also called condition-based maintenance, as the degrading state of an item is estimated to schedule a maintenance. Machine Learning is widely used for predictive maintenance.

A turbojet engine is a jet engine which produces all of its thrust by ejecting a high energy gas stream from the engine exhaust nozzle. In contrast to a turbofan or bypass engine, 100% of the air entering the intake of a turbojet engine goes through the engine core.

A turboshaft engine is a form of gas turbine that is optimized to produce shaft power rather than jet thrust. In concept, turboshaft engines are very similar to turbojets, with additional turbine expansion to extract heat energy from the exhaust and convert it into output shaft power.

A turbofan engine is the most modern variation of the basic gas turbine engine. As with other gas turbines, there is a core engine, whose parts and operation are discussed on a separate page. In the turbofan engine, the core engine is surrounded by a fan in the front and an additional turbine at the rear. The fan and fan turbine are composed of many blades, like the core compressor and core turbine, and are connected to an additional shaft.

The engine has a low-pressure compressor driven by a multi-stage turbine; the power to drive the turbine is derived from combustion of kerosene and liquid oxygen in a rocket type combustion chamber.

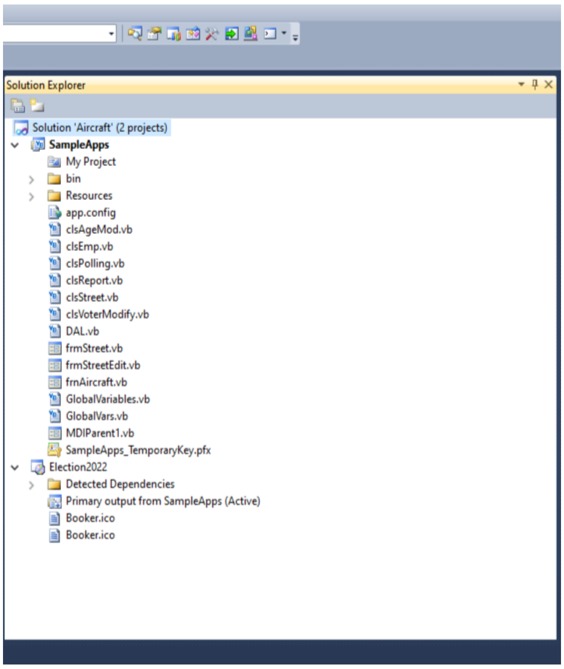
SPRINT 4

The first step in a VB.Net application is to create an instance of the Server object and to establish its connection to an instance of SQL Server. The SqlConnection Object is Handling the part of physical communication between the application and the SQL Server Database.

The connection string is an expression that contains the parameters required for the applications to connect a database server. In terms of SQL Server, connection strings include the server instance, database name, authentication details, and some other settings to communicate with the database server.

Right-click on your connection and select "Properties". You will get the Properties window for your connection. Find the "Connection String" property and select the "connection string".

The string is a collection of characters put to use for storing multiple characters. Most of the data present around us is a string like our name, our address, etc. We oftenrequire modification and access to the strings around us.



6.2 Sprint Delivery Schedule

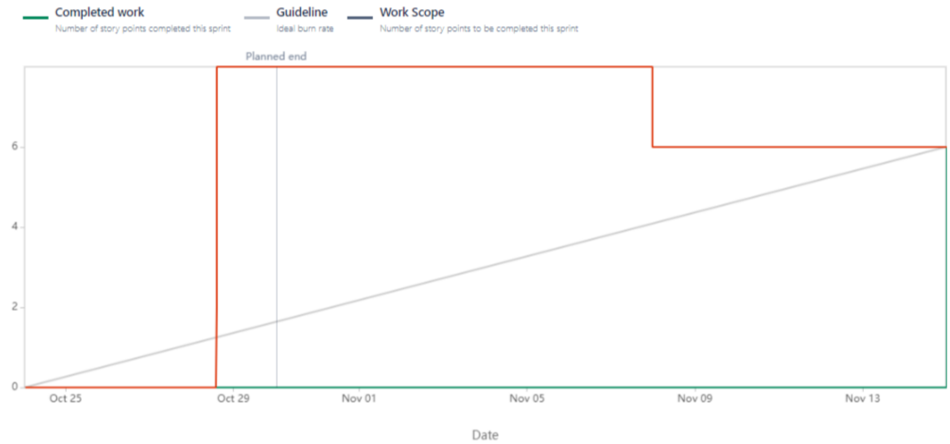
Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	2	High	Nawin D R
Sprint-1		USN-2	As a user, I will receive confirmation alert message once I have registered for the application.	1	High	SelvaVarshini S
Sprint-1		USN-3	As a user, I can register for the application through Facebook, Instagram, other social media.	1	Low	Priyadharshini K
Sprint-1		USN-4	As a user, I can register for the application through Gmail.	2	Medium	Dheebakraj A
Sprint-2	Login	USN-5	As a user, I can log into the application by entering email & password.	3	High	Nawin D R
Sprint-2	Dashboard	USN-6	As a user, I can navigate through different pages using the dashboard.	3	High	SelvaVarshini S
Sprint-3	Search	USN-7	As a user, I can search for the issues associated with the engine problem that I am facing.	3	High	Dheebakraj A
Sprint-3	View	USN-8	As a user, I can view the details of aircraft engine and the issue and its severity and ask for support.	4	High	Priyadharshini K

Sprint-4	Analyze	USN-9	As an admin, I will analyze the situation and suggest an alternative method to tackle the engine failure.	4	High	SelvaVarshini S
Sprint-4	Predict	USN-10	As an admin, I will predict the aircraft engine failure and provide tech support.	5	High	Nawin D R

Table 6.1 Sprint Delivery Schedule

6.3 Reports from JIRA:

Burndown Chart:



Road Map:

CHAPTER-7

CODING AND SOLUTIONS

7.1 Feature 1:

Microsoft ActiveX Data Objects.Net (ADO.Net) is a model, a part of the .Net framework that is used by the .Net applications for retrieving, accessing and updating data. An application accesses data either through a dataset or a data reader.

- Datasets store data in a disconnected cache and the application retrieves data from it.
- Data readers provide data to the application in a read-only and forward-only mode.

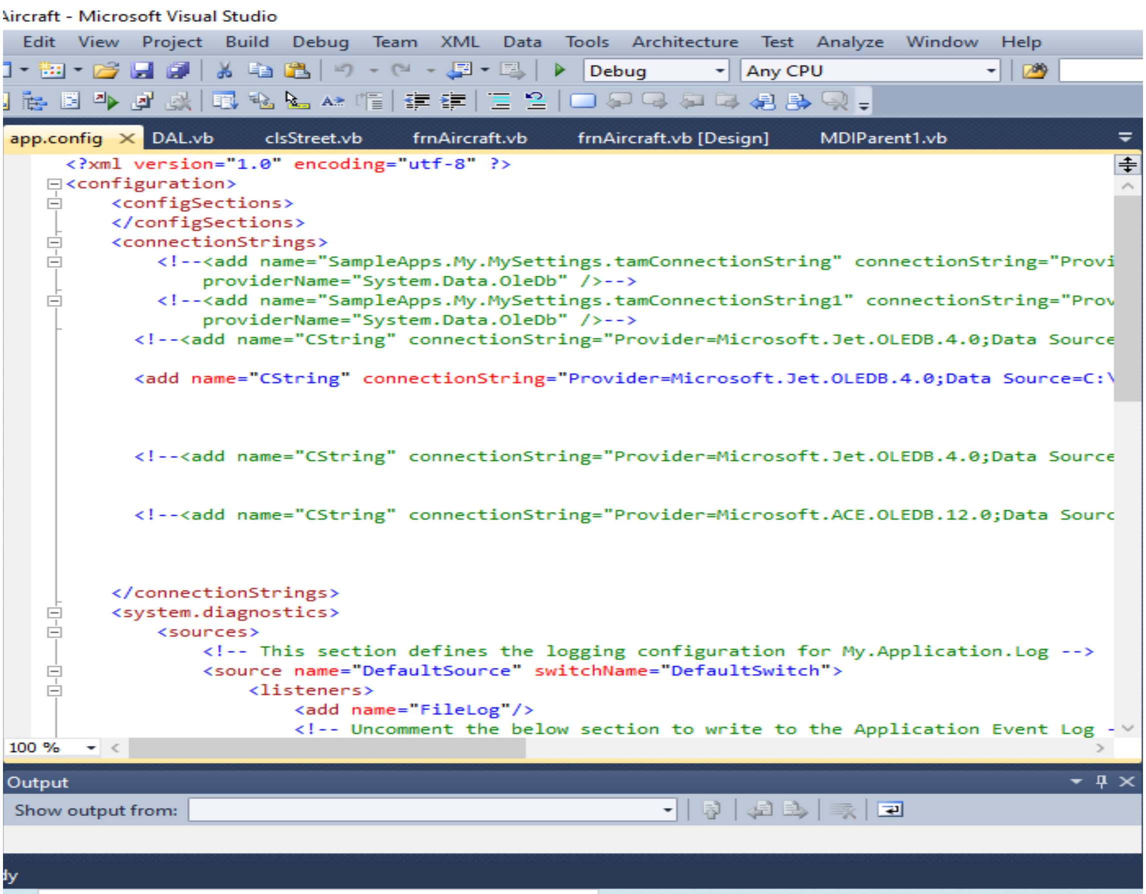


Figure:7.1 Feature 1

7.2 Feature 2:

There are following different types of data providers included in ADO.Net

- The .Net Framework data provider for SQL Server - provides access to Microsoft SQL Server.
- The .Net Framework data provider for OLE DB - provides access to data sources exposed by using OLE DB.
- The .Net Framework data provider for ODBC - provides access to data sources exposed by ODBC.
- The .Net Framework data provider for Oracle - provides access to Oracle data source.

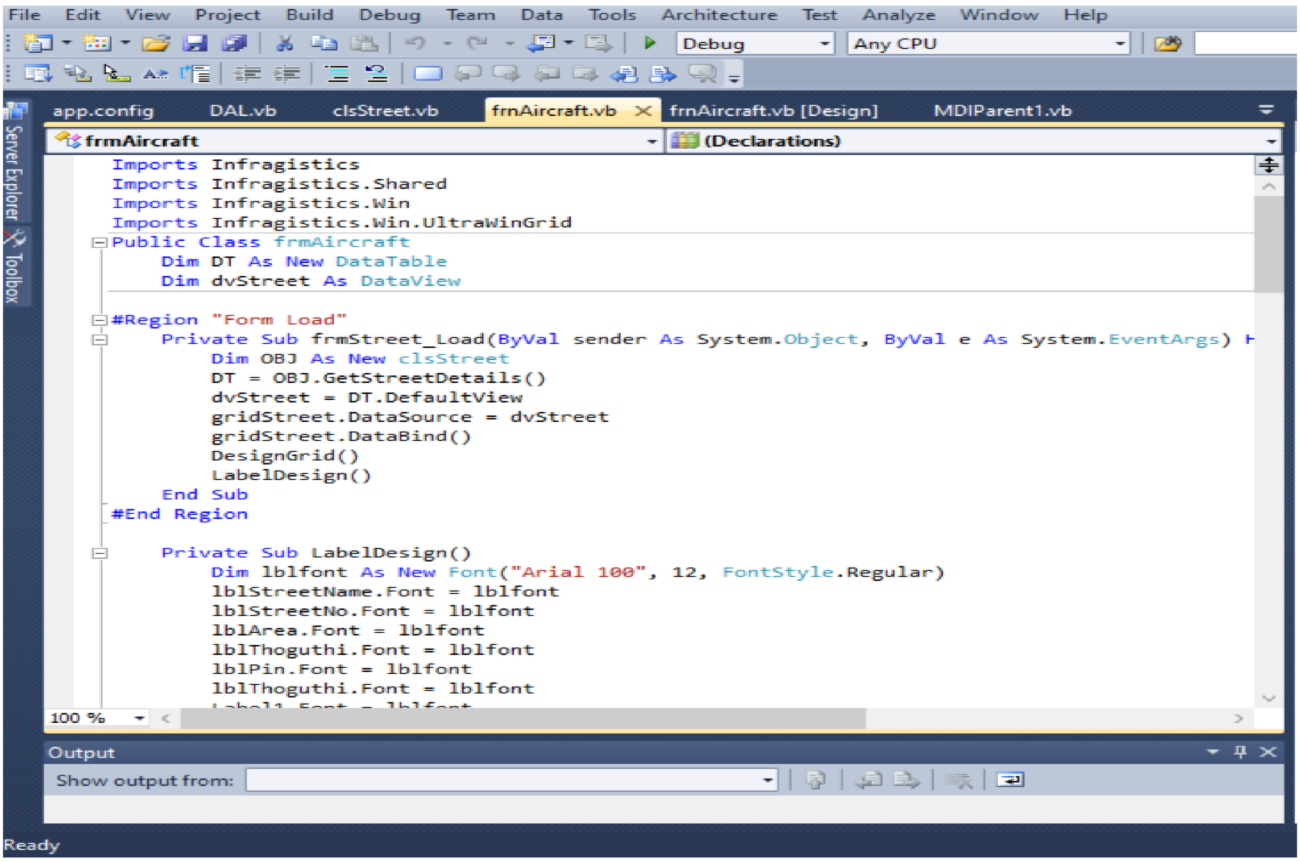


Figure:7.2 Feature 2

CHAPTER-8

TESTING

8.1 Test Cases:

Test Case 1:

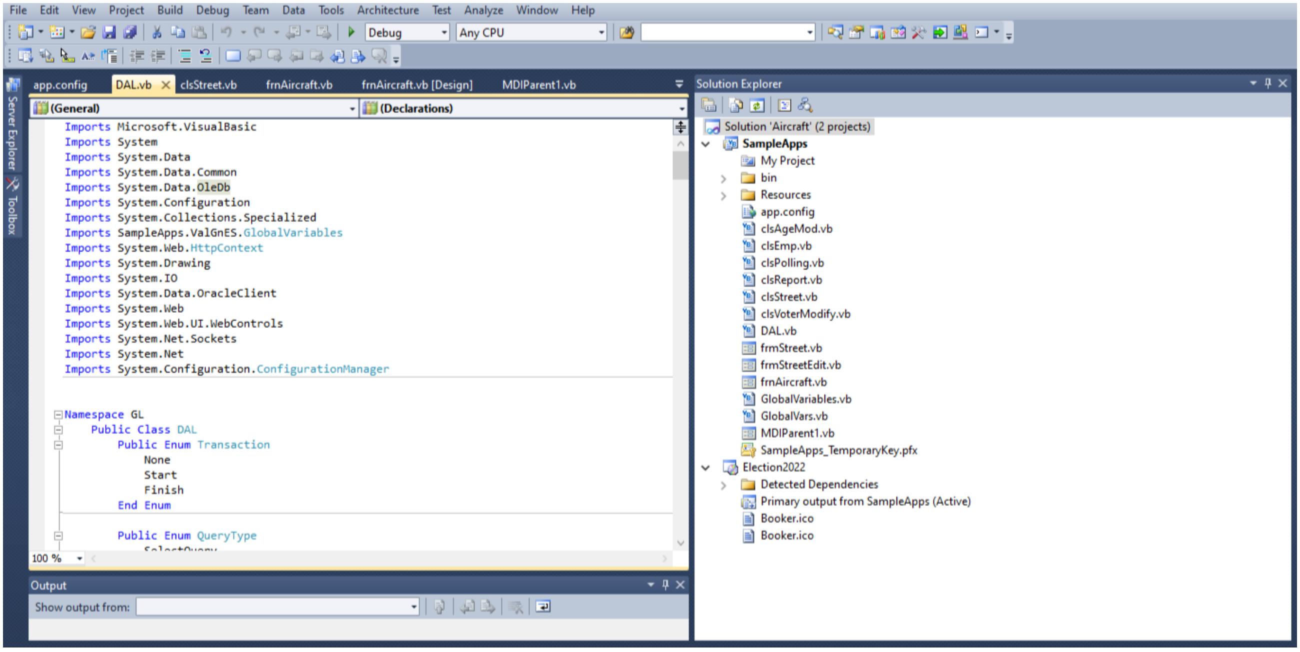


Figure 8.1 Test Case

Test Case 2:

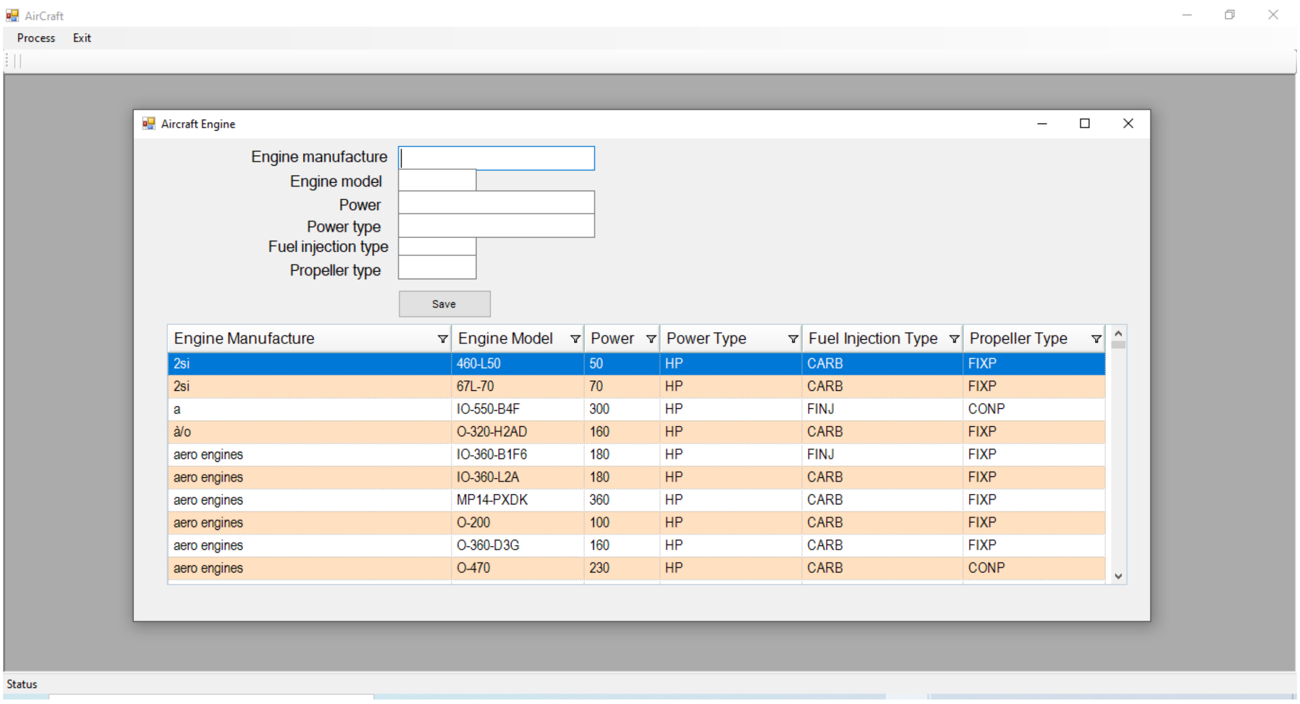


Figure 8.2 Test Case

8.2 User Acceptance Testing

The purpose of this document is to briefly explain the test coverage and open issues of the Machine learning-based predictive analytics for aircraft engine project at the time of the release to the User Acceptance Testing (UAT)

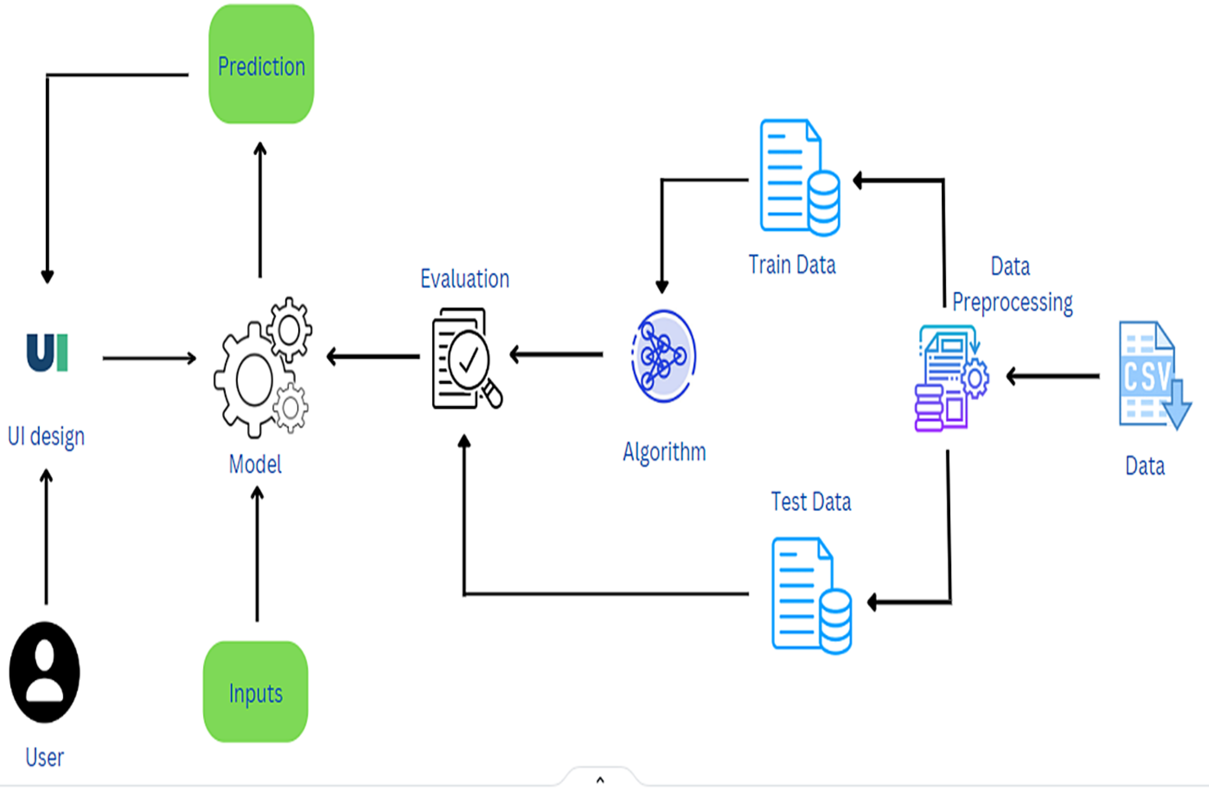


Figure 8.3 User Acceptance Testing

CHAPTER-9

RESULTS

9.1 PERFORMANCE METRICS

The Predictive maintenance refers to the techniques in determining the conditions of in-service equipment for the purpose of predicting maintenance procedures prior to the occurrences of failures and secondly, preventing failures from occurring by performing maintenance. The techniques would predominantly utilize performance data generated by the equipment and several other data sources such as maintenance records from repair centers. Therefore, predictive maintenance would ideally result in lower maintenance frequency in order to prevent unscheduled reactive maintenances. Hence, the approach would eliminate the fact of incurring costs associated with performing frequent preventive maintenance.

Engine Manufacture	Engine Model	Power	Power Type	Fuel Injection Type	Propeller Type
aero engines	IO-360-B1F6	180	HP	FINJ	FIXP
aero engines	IO-360-B1F6	180	HP	FINJ	FIXP
aero engines	IO-360-L2A	180	HP	CARB	FIXP
aero engines	IO-360-L2A	180	HP	CARB	FIXP
aero engines	MP14-PXDK	360	HP	CARB	FIXP
aero engines	MP14-PXDK	360	HP	CARB	FIXP
aero engines	O-200	100	HP	CARB	FIXP
aero engines	O-200	100	HP	CARB	FIXP
aero engines	O-360-D3G	160	HP	CARB	FIXP
aero engines	O-360-D3G	160	HP	CARB	FIXP

Figure 9.1 Detail Test plan

Engine Manufacture	Engine Model	Power	Power Type	Fuel Injection Type	Propeller Type
aero engines	IO-360-B1F6	180	HP	FINJ	FIXP
aero engines	IO-360-B1F6	180	HP	FINJ	FIXP

Figure 9.2 End Of Test plan

CHAPTER-10

ADVANTAGES AND DISADVANTAGES

Advantages:

1. Machine Learning (ML) methods are effective for Predictive Maintenance.

2. The blades spin at high speed and compress or squeeze the air.

3. It uses predictive analysis in order to optimize the performance of aircrafts.

4. An aircraft engine, or powerplant, produces thrust to propel an aircraft.

5.The global commercial aircraft engine market is prioritizing solutions that increase aircraft fuel efficiency.

6.Predicting the remaining useful life of a machine, so that they can enhance operations and reduce flight delays.

7.The reliability analysis is also important to predict their scheduled maintenance event and the RUL of engine parts.

Disadvantages:

1. A small error in the algorithm or data results in a large amount of loss.

2. Not all people trust the recommendation systems.

3. Not Accurate at All the time Due to Lack of Data.

CHAPTER-11

CONCLUSION

This project work is the implemented to improve the accuracy of Thrust-specific fuel consumption (TSFC) prediction, the database needs to be expanded. However, the limitation of publicly available engine data is a challenge to overcome. Overall, the results show that by bringing together sufficient (big) high quality data, robust machine learning algorithms, and data science, machine learning-based predictive analytics can be an effective tool for engine design-space exploration during the conceptual design phase. It would help to identify the best engine design expeditiously amongst several candidates. The air at the upper surface travels faster over the airfoil compared to the air at the bottom surface causing a difference in pressure. As the air flows over the upper surface which is curved, the air tries to move in a straight line, but the curved shape of the airfoil pulls it around and back down. Increasing compression is the most productive way to increase horsepower. Build compression into your engine and you build in power. In more than a century of internal combustion, there has never been a more common sense way to make power. But be careful about how you raise compression.

CHAPTER-12

FUTURE SCOPE

The promising results of the predictive analytics show that machine-learning techniques merit further exploration for application in aircraft engine conceptual design. An aircraft engine, or powerplant, produces thrust to propel an aircraft. Reciprocating engines and turboprop engines work in combination with a propeller to produce thrust. Turbojet and turbofan engines produce thrust by increasing the velocity of air flowing through the engine. The engine is a lot like the brain of a car. It holds all the power necessary to help your car function. An aircraft engine is the component of the propulsion system for an aircraft that generates mechanical power. Aircraft engines are almost always either lightweight piston engines or gas turbines. Engines that have high capacities for oil and coolant generally do a better job of handling the thermal stresses in an engine. Think of this as having more ammunition to fight an enemy. When engines have more room for coolant and oil, they have more firepower to fight back against the engines, well, firepower. Engine performance is often characterized by the engine operating behavior in the speed–load domain, for example, the behavior of emissions, fuel consumption, noise, mechanical and thermal loading.

CHAPTER-13

APPENDIX

13.1 SOURCE CODE

```
<!DOCTYPE html>
<html xmlns="http://www.w3.org/1999/xhtml">
<head>
    <title></title>
</head>
<script
src="http://ajax.googleapis.com/ajax/libs/angularjs/1.3.14/angular.min.js"></script>
<body ng-app="Myapp" ng-controller="ctlemp as h">
    <style>
        body {
          background-image: url('./Image\ 01.jpg');
          background-attachment: fixed;
          background-size: cover;
        }
        </style>
<div ng-switch on="h.page">
    <div ng-switch-when="EmpOffice" ng-controller="Myc as c">
    <form>
        <hr>
    <table cellpadding="3" cellspacing="0">
        <!--<tr>
            <td></td>
            <td></td>
            <td></td>
            <td></td>
            <td colspan="3">sample</td>
        </tr>-->
        <legend ><b>Aircraft Engine Prediction</b></legend>
        <tr>
```

```
        <td>
            Engine Name:
        </td>
        <td>
            <input type="text" ng-model="c.employee.UserName" />
        </td>
    </tr>
    <tr>
        <td>
            Power type:
        </td>
        <td>
            <input type="radio" name="Power" value="HP" ng-
model="c.employee.Gender"/>HP<input type="radio" name="Power" value="LP" ng-
model="c.employee.Gender"/>LP
        </td>
    </tr>
    <tr>
        <td>
            Engine Model:
        </td>
        <td>
            <select ng-options="dep.Id as dep.Name for dep in c.loaddep" ng-
model="c.employee.Admin"/>
        </td>
    </tr>
    <tr>
        <td>
            Power:
        </td>
        <td>
            <select ng-options="city.Id as city.Name for city in c.loadcity" ng-
model="c.employee.City"/>
        </td>
```

```
        </tr>
        <tr>
            <td>
                Reporting to:
            </td>
            <td>
                <input type="text" ng-model="c.employee.Email"/>
            </td>
        </tr>
        <tr>
            <td>
                Engine Description:
            </td>
            <td>
                <textarea rows="4" cols="10" ng-model="c.employee.Address"></textarea>
            </td>
        </tr>
        <tr>
            <td>
                Engine Failure Causes:
            </td>
            <td>
                <input type="checkbox" ng-model="c.employee.Travelling"
value={{c.loadinterset[0].Id}}>{{c.loadinterset[0].Name}}</input>
                <input type="checkbox" ng-model="c.employee.Movies"
value={{c.loadinterset[1].Id}}>{{c.loadinterset[1].Name}}</input>
                <input type="checkbox" ng-model="c.employee.Music"
value={{c.loadinterset[2].Id}}>{{c.loadinterset[2].Name}}</input>
            </td>
        </tr>
        <tr>
            <td>
                Verification:
            </td>
```

```
          <td>
            <input type="checkbox" ng-model="c.employee.Accepting"></input>
          </td>
        </tr>
        <tr>
          <td  colspan ="2" align = "center">
            <button ng-click="c.addemp()">Predit</button>
            <button ng-click="c.filteremp()">Filter</button>
          </td>
        </tr>
    <table>
    </form>
    <hr />
    <span ng-show="c.employee.filter">
        <br />
        <br />
        Filter: <input type="text" ng-model="c.employee.filterby" />
        <br />
        <br />
        <hr />
    </span>
<table cellpadding="3" cellspacing="0" border="1">
    <tr>
        <th>S. No</th>
        <th>Engine Name</th>
        <th>Power type</th>
        <th>Engine Model</th>
        <th>Power</th>
        <th>Reporting to</th>
        <th>Engine Description</th>
        <th>Engine Failure Details (Air Blockage, Fuel Exhaustion, Carburettor
ice)</th>
        <th>Verification</th>
    </tr>
```

```
   <tr ng-repeat="e in c.emplist|filter:c.employee.filterby">
      <td>{{$index+1}}</td>
      <td>{{e.UserName}}</td>
      <td>{{e.Gender}}</td>
      <td>{{e.Admin}}</td>
      <td>{{e.City}}</td>
      <td>{{e.Email}}</td>
      <td>{{e.Address}}</td>
      <td>{{e.Travelling}},{{e.Movies}},{{e.Music}}</td>
      <td>{{e.Accepting}}</td>
      <td>
         <button ng-click="c.Edit($index)">Edit</button>
      </td>
      <td>
         <button ng-click="c.rmemp($index)">Delete</button>
      </td>
   </tr>
   </table>
   <hr />
 </div>
<div ng-switch-when="EmpPro" ng-controller="Myc as c">
employee Personal Details
</div>

</div>
   <script>
      function empCities() {


         this.cities = [{ "Id": 1, "Name": "Above 50", "State": "Tamilnadu" },
        { "Id": 2, "Name": "Above 100", "State": "Delhi" },
        { "Id": 3, "Name": "Above 150", "State": "Maharastra" },
        { "Id": 4, "Name": "Above 200", "State": "Maharastra" },
        { "Id": 5, "Name": "Above 250", "State": "Karnataka" }]
      }
      function empDepartment() {
```

```
    this.departments = [{ "Id": 1, "Name": "A-12345", "Manager": "Model" },
    {"Id":2,"Name":"B-12345","Manager":"Model"},
    {"Id":3,"Name":"C-12345","Manager":"Model"},
    {"Id":4,"Name":"D-12345","Manager":"Model"}]
}
function empInterest() {


    this.interests = [{ "Id": 1, "Name": "Air Blockage" },
        { "Id": 2, "Name": "Fuel Exhaustion" },
        { "Id": 3, "Name": "Carburettor ice" }];
}
function empdetails() {
   var self = this;
    self.UserName = '';
    self.Gender = '';
    self.City = '';
    self.Admin = '';
    self.Email = '';
    self.Address = '';
    self.CreatePassword = '';
    self.Travelling = true;
    self.Movies = false;
    self.Music = true;
    self.filter = false;
    self.Accepting = '';
    self.filterby = '';
}
function empmgm() {
    var self = this;
    self.index;
    self.employee = new empdetails();
    self.emplist = [];
    self.loaddep = new empDepartment().departments;
```

```
        self.loadcity = new empCities().cities;
        self.loadinterset = new empInterest().interests;
        self.addemp = function (){
                        self.emplist.push(self.employee);
                        self.employee = new empdetails();
                        console.log('Emp Added');
                       };
        self.rmemp = function (i){
                        self.emplist.splice(i,1);
                        console.log('Last Emp Delete');
        };
        self.filteremp = function () {
          self.employee.filter = !self.employee.filter;
        };
        self.Edit = function (i) {
          self.employee= self.emplist[i]
          self.employee.filterby = self.emplist[i].Name;
          self.index = i;
        };
        self.Updatemp = function () {
          self.emplist[self.index] = self.employee
          self.employee.filterby = "";
          self.employee = new empdetails();
        }

      }
      var app = angular.module("Myapp", []);
      app.controller("ctlemp", [function () {
        this.page = "EmpOffice";
         }]);
      app.controller("Myc", [empmgm]);
    </script>
</body>
</html>
```

13.2 SCREENSHOTS

SPRINT 1

Figure 13.2.1 Sprint-1

SPRINT 2

Figure 13.2.2 Sprint-2

SPRINT 3

Figure 13.2.3 Sprint-3(1)

Figure 13.2.4 Sprint-3(2)

Figure 13.2.5 Sprint-3(3)

Figure 13.2.6 Sprint-3(4)

SPRINT 4

Figure 13.2.7 Sprint-4

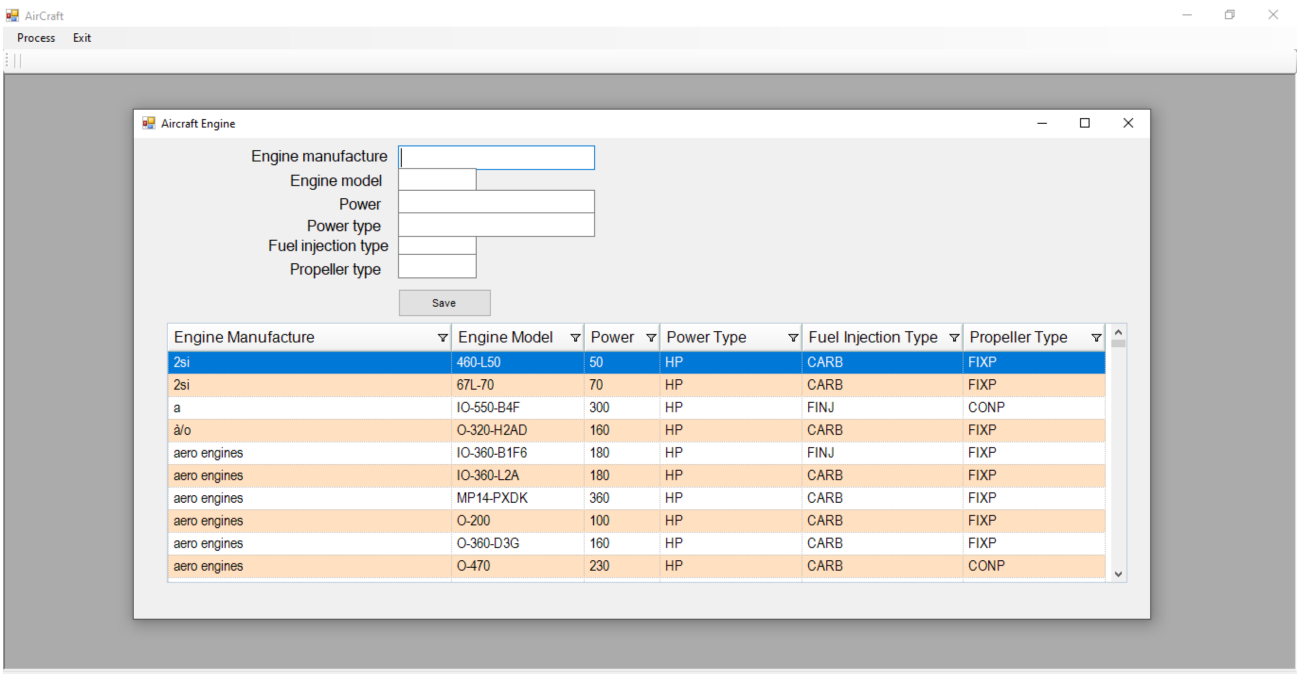


Figure 13.2.8 Sprint-4

13.3 GitHub & Project Demo Link

Table 13.3. GitHub & Project Demo Link

Content	**Link**
GitHub	**https://github.com/IBM-EPBL/IBM-Project-39185-1660399452**
Project Demonstration Video	https://youtu.be/gM4z0i6vZWs

CHAPTER-14

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