National College of Ireland

Configuration Manual

Analyse of 3D geometrical STEP file for feature recognition

MSc Research Project

MSc in AI for business

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MSc Project Submission Sheet

School of Computing

Student Name: ……..Adil Abdullah……

Student ID: ……x23114631……..……

Programme: ……MSc in AI for Business…… **Year:** ……2023/24…….

Module: ……3……..……

Lecturer: ……Practicum 3……..……

Submission Due Date: ……16-09-2024……..……

Project Title: .....Analyse of 3D geometrical STEP file for feature recognition.....

Word Count: ……694…… **Page Count:** ……12……..……

I hereby certify that the information contained in this (my submission) is information pertaining to research I conducted for this project. All information other than my own contribution will be fully referenced and listed in the relevant bibliography section at the rear of the project.
ALL internet material must be referenced in the bibliography section. Students are required to use the Referencing Standard specified in the report template. To use other author's written or electronic work is illegal (plagiarism) and may result in disciplinary action.

Signature: ……ADIL ABDULLAH……

Date: ……16-09-2024……

PLEASE READ THE FOLLOWING INSTRUCTIONS AND CHECKLIST

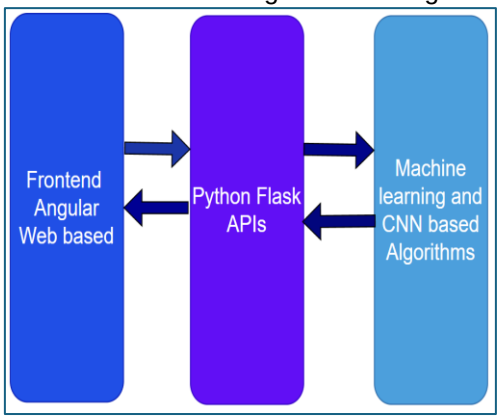
Attach a completed copy of this sheet to each project (including multiple copies)	□
Attach a Moodle submission receipt of the online project submission, to each project (including multiple copies).	□
You must ensure that you retain a HARD COPY of the project, both for your own reference and in case a project is lost or mislaid. It is not sufficient to keep a copy on computer.	□

Assignments that are submitted to the Programme Coordinator Office must be placed into the assignment box located outside the office.

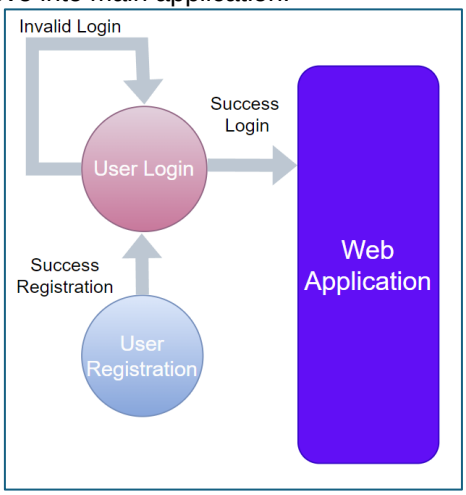
Office Use Only	
Signature:	
Date:	
Penalty Applied (if applicable):	

Architecture:

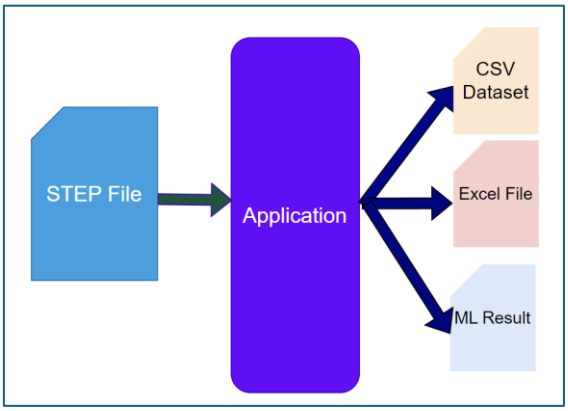
1. High Level Multi 3 Tier Flow:
   The application is Angular at frontend then goes to API which is based in Python Flask framework and then to core Machine learning and CNN algorithm written on python.



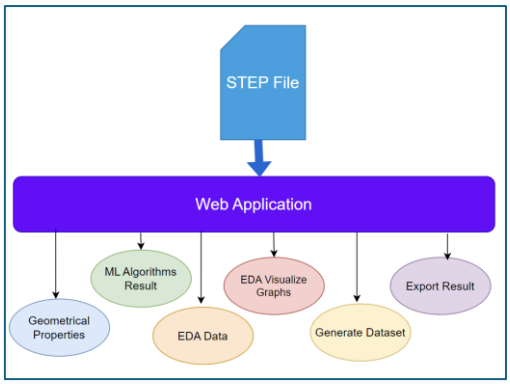
2. User Login Flow:
   User first register themselves if success then login and same time notifies through his/her email. Then login to move into main application.



3. File Process Flow:
   Once in main application STEP geometrical file will be uploaded on application from user system and after processes of file then it will be available to download in different formats.



4. File Uploading and Result Flow Process:
   Once STEP file uploaded successfully you can view EDA, geometrical properties, EDA visualize chart and ML process and their result from your uploaded STEP file.

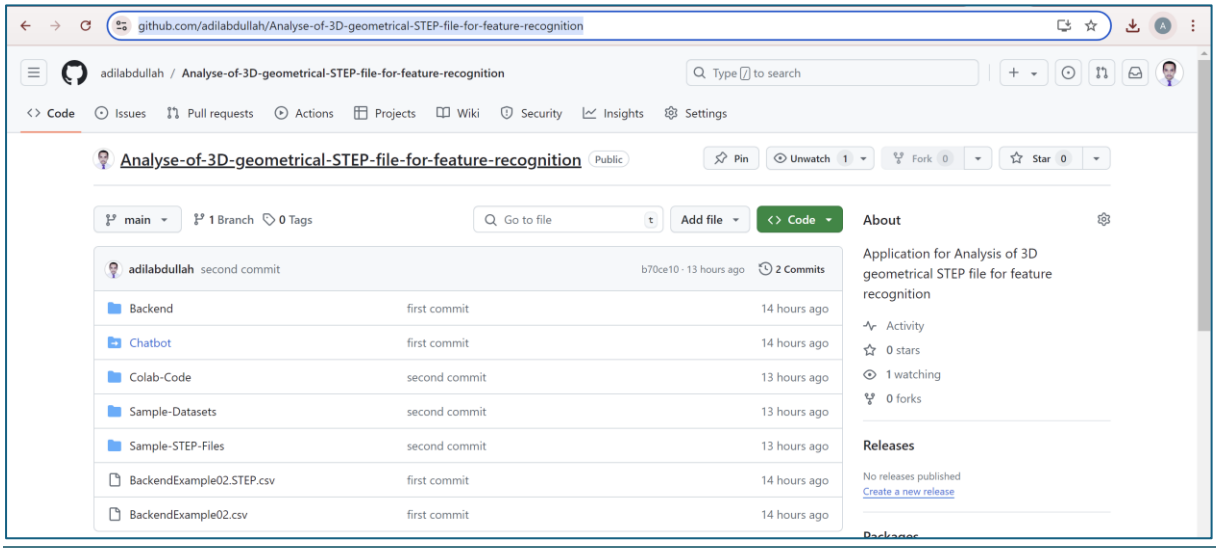


Step 1:

Clone below provided GitHub repository URL on any folder in your local system. First open command prompt moved on the folder where you want to clone and run below command.

git clone https://github.com/adilabdullah/Analyse-of-3D-geometrical-STEP-file-for-feature-recognition

URL: https://github.com/adilabdullah/Analyse-of-3D-geometrical-STEP-file-for-feature-recognition

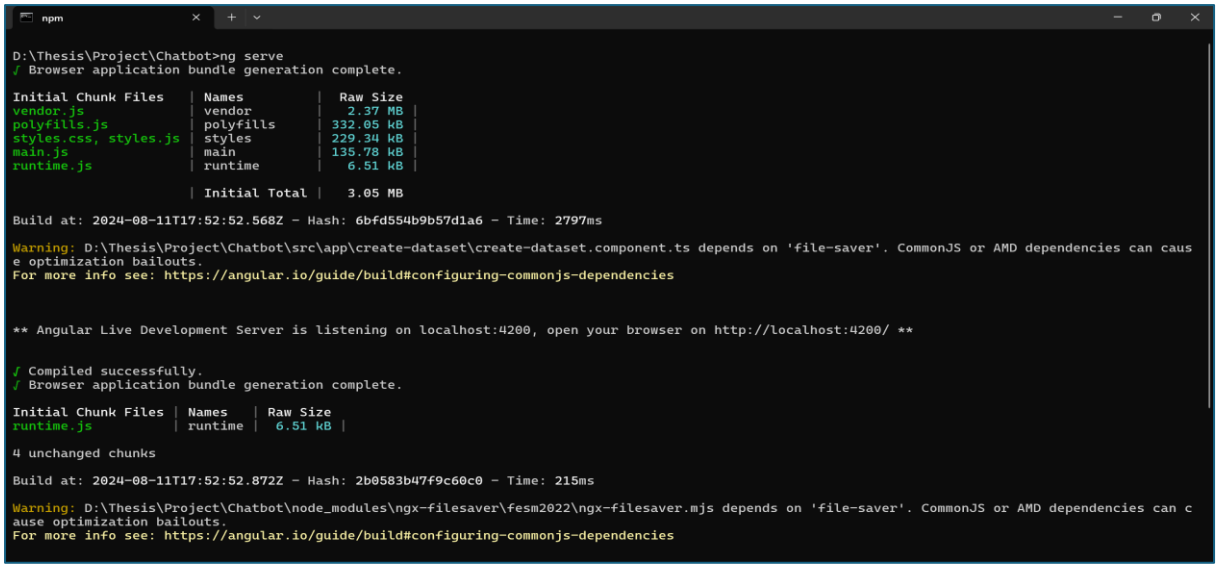


Step 2:

After successful cloning in previous step go to Chatbot folder inside your project folder and open CMD there and run below command.

<project-folder>\Chatbot>ng serve

This will run your frontend angular application



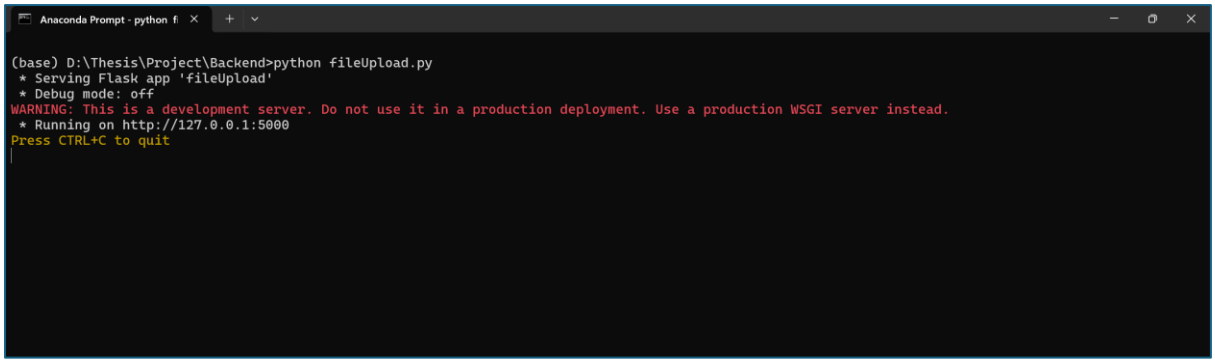
Note: Must ensure that node is install on your system by run below command on cmd.

Node -v

Step 3:

Now move back onto main project folder where you clone and go to Backend folder and open CMD there to run below command.

<project-folder>\Backend>python fileUpload.py



Note: Must ensure that python is install on your system by run below command on cmd.

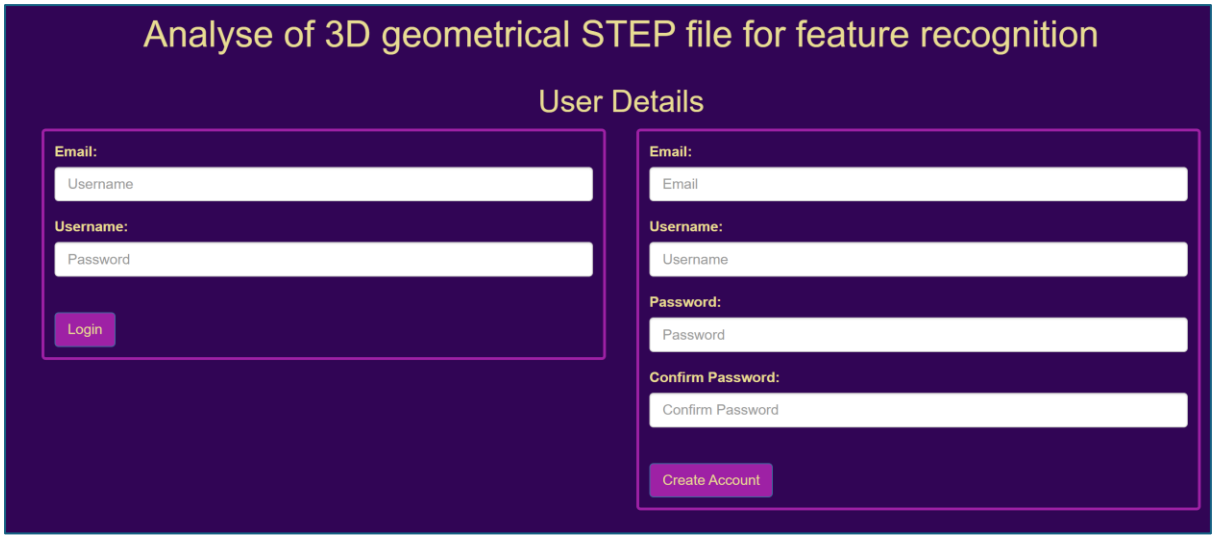
python -v

Step 4:

After running frontend and backend both from step 1 & 2. Now its time to run application for this open browser and write below URL to access it.

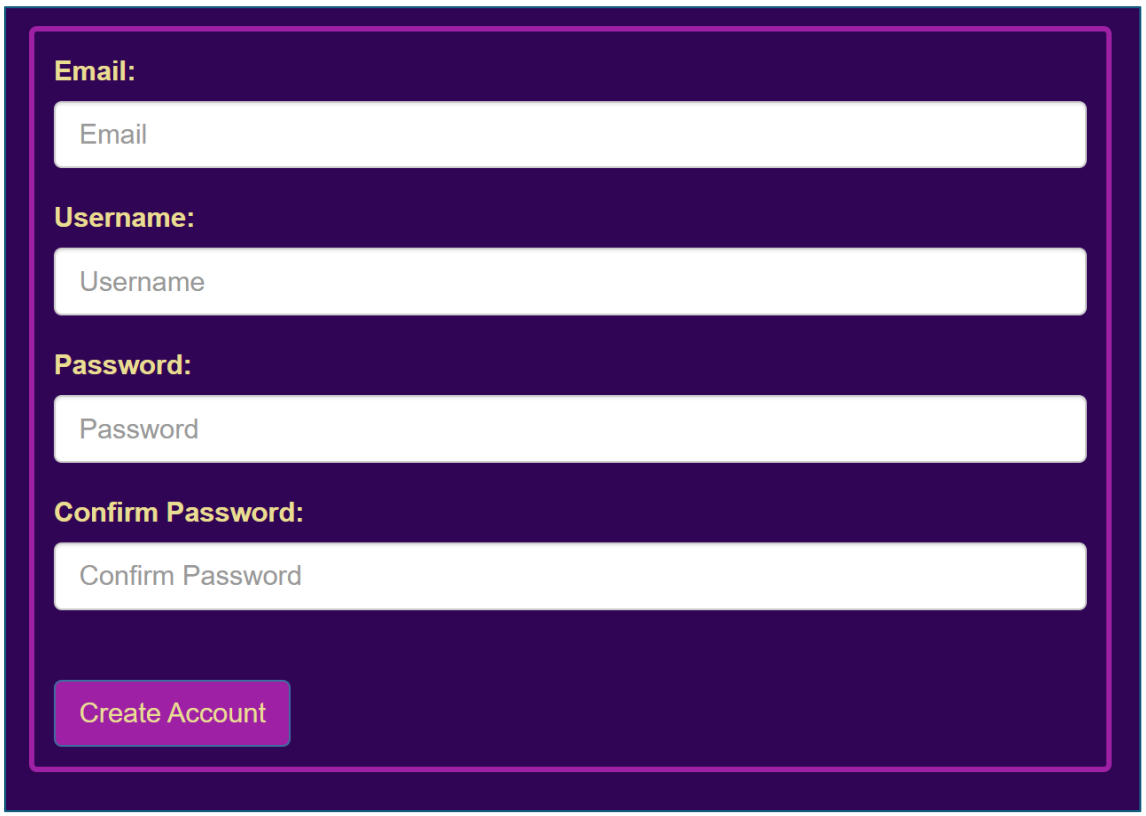
URL: http://localhost:4200/login

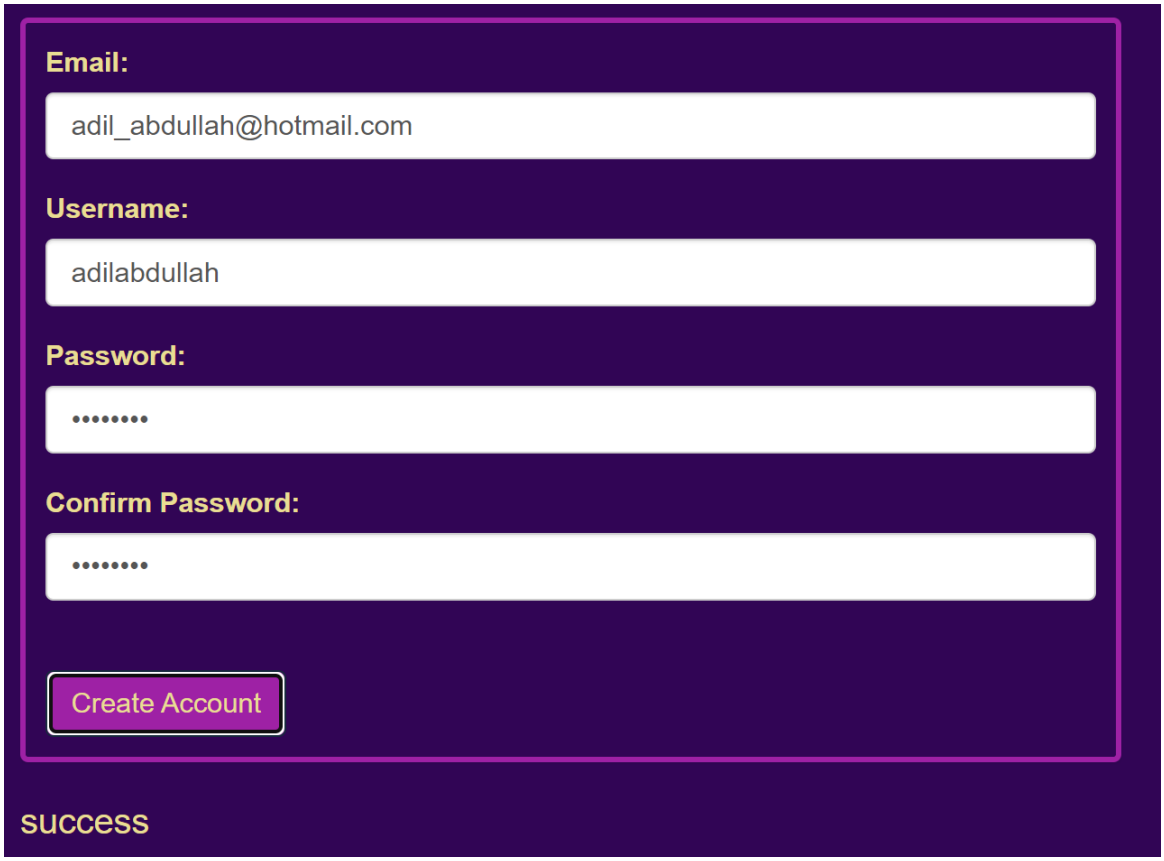
Below is the UI of above URL where right side is registration form and left is login.



Step 5:

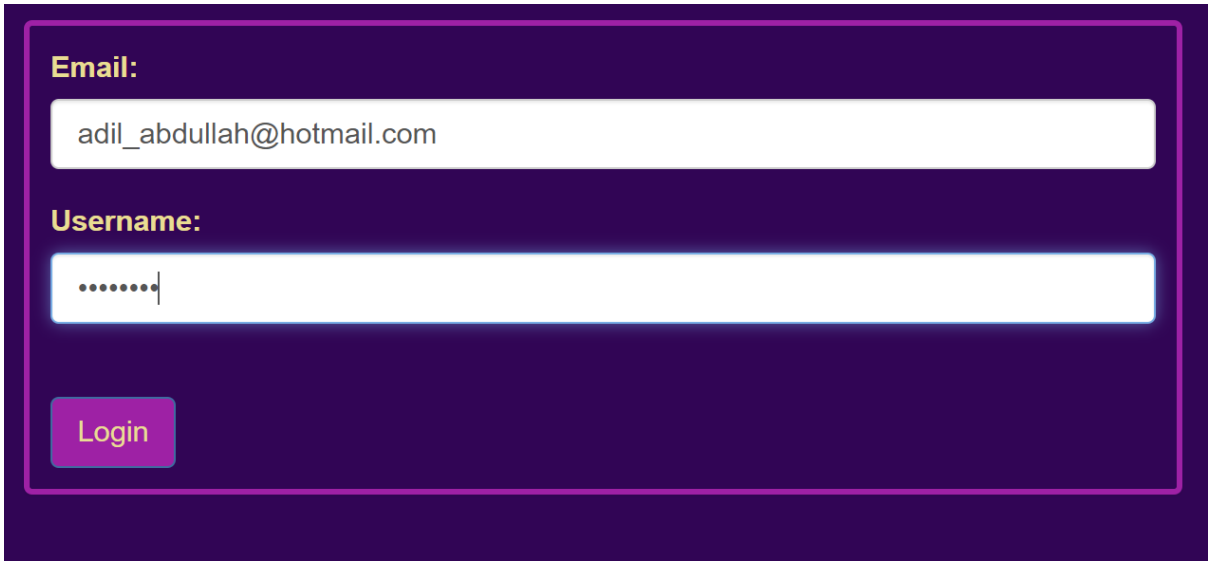
After opening URL in step 3 below is the screenshot of left side registration where you can register by input your email, username and password by click on create account button.





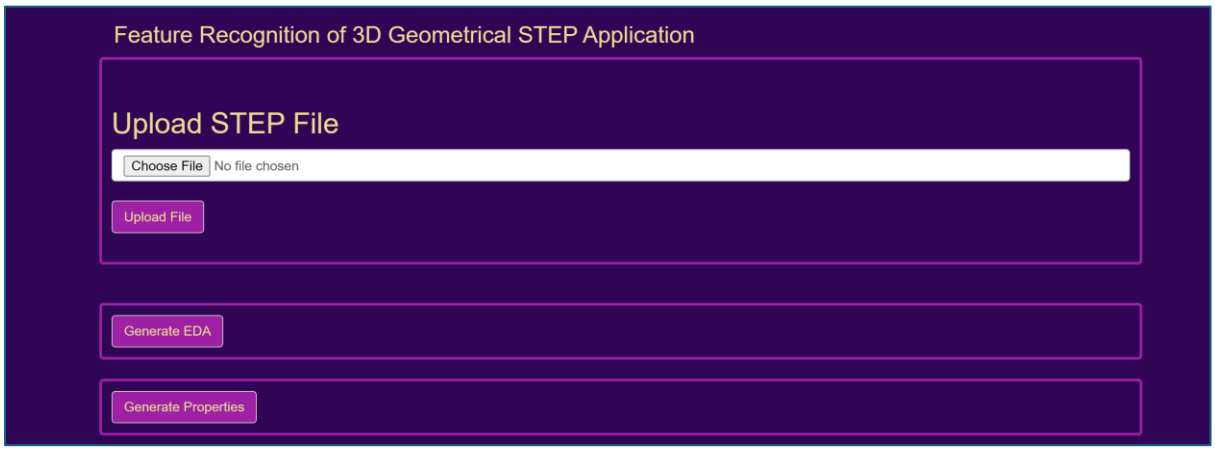
Step 6:

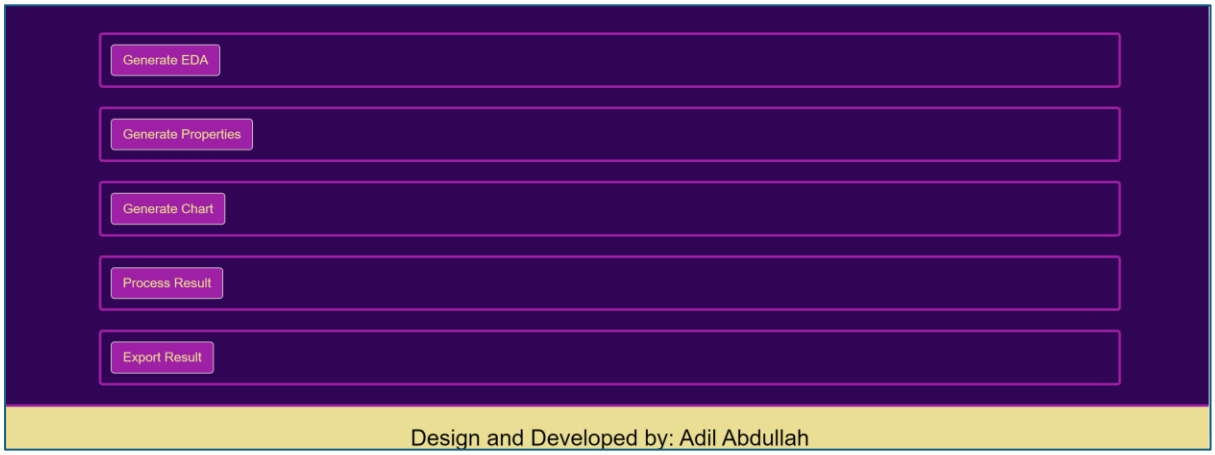
After opening URL in step 3 below is the screenshot of right-side user login where you can login by input your either email or username and password by clicking on login button.



Step 7:

After successful login on step 5 main application view is routed as screenshot below with multiple options.



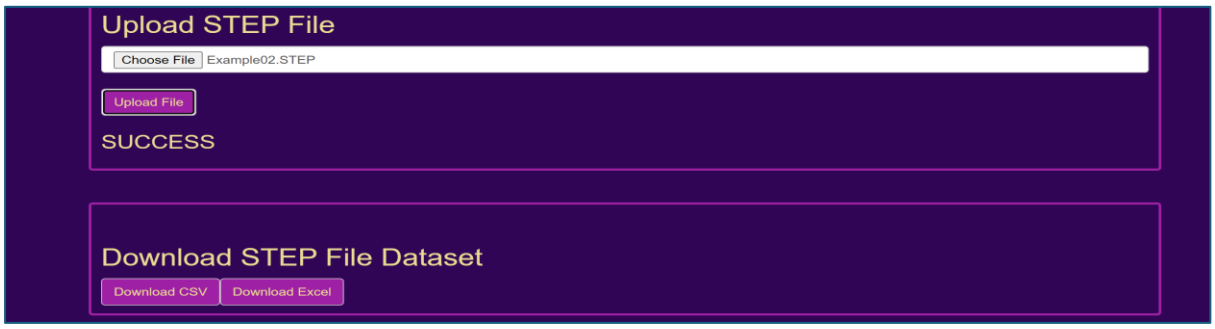


Step 8:

After routed on main application page first option upload STEP file which you have to upload from your local system by clicking on choose file button and then on upload file.

Step 9:

After successful file upload on step 8 download tab will display to download file either on CSV or excel format. Below is the screenshot and sample CSV format.

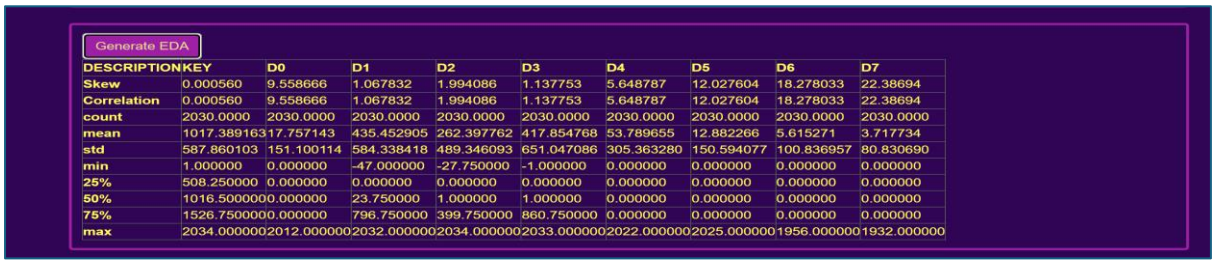


Sample Dataset:

KEY	ENTITY	D0	D1	D2	D3	D4	D5	D6	D7	REFERENCES
2	CARTESIAN	0	0	0	1148	0	0	0	0	[1148]
4	PRODUCT	0	1399	17.5	0	0	0	0	0	[1399]
5	PERSON	0	1820	1815	0	0	0	0	0	[1820, 1815]
6	CIRCLE	0	1235	259	0	0	0	0	0	[1235, 259]
7	EDGE_LOO	0	1403	2.75	0	0	0	0	0	[1403]
8	LINE	0	1221	10	0	0	0	0	0	[1221, 10]
9	CIRCLE	0	349	13	0	0	0	0	0	[349, 13]
10	LINE	0	1227	1000	0	0	0	0	0	[1227]
11	LINE	0	801	1000	0	0	0	0	0	[801]
12	VECTOR	0	350	1000	0	0	0	0	0	[350]
13	VECTOR	0	352	1000	0	0	0	0	0	[352]
14	VECTOR	0	268	78	0	0	0	0	0	[268, 78]
15	VECTOR	0	798	16	0	0	0	0	0	[798, 16]
16	LINE	0	799	1000	0	0	0	0	0	[799]
17	LINE	0	1234	253	0	0	0	0	0	[1234, 253]
18	VECTOR	0	1558	2.1	1.029744	0	0	0	0	[1558]
19	LINE	0	1915	1883	1913	2009	0	0	0	[1915, 1883, 1913, 2009]
20	CONICAL_S	0	1408	2.1	0	0	0	0	0	[1408]
21	EDGE_LOO	0	1790	1793	1788	1791	0	0	0	[1790, 1793, 1788, 1791]
22	CIRCLE	0	1206	1000	0	0	0	0	0	[1206]
23	EDGE_LOO	0	1420	3.3	0	0	0	0	0	[1420]
24	VECTOR	0	21	1	0	0	0	0	0	[21]
25	CYLINDRIC	0	194	1	0	0	0	0	0	[194]
26	FACE_OUTE	0	210	1	0	0	0	0	0	[210]

Step 10:

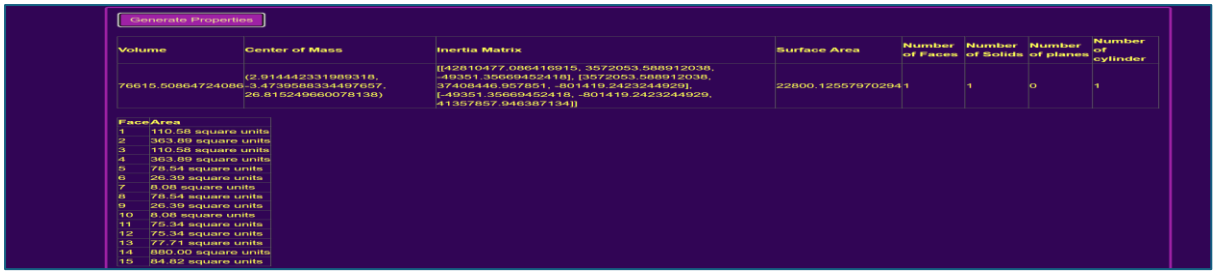
Next tab is generating EDA by clicking on it you can view exploratory data analysis (EDA) of your uploaded STEP file in tabular format.



DESCRIPTION	KEY	D0	D1	D2	D3	D4	D5	D6	D7
Skew	0.000560	9.558666	1.067832	1.994086	1.137753	5.648787	12.027604	18.278033	22.38694
Correlation	0.000560	9.558666	1.067832	1.994086	1.137753	5.648787	12.027604	18.278033	22.38694
count	2030.0000	2030.0000	2030.0000	2030.0000	2030.0000	2030.0000	2030.0000	2030.0000	2030.0000
mean	1017.38916	17.757143	435.452905	262.397762	417.854768	53.789655	12.882266	5.615271	3.717734
std	587.860103	151.100114	584.338418	489.346093	651.047086	305.363280	150.594077	100.836957	80.830690
min	1.000000	0.000000	-47.000000	-27.750000	-1.000000	0.000000	0.000000	0.000000	0.000000
25%	508.250000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
50%	1016.500000	0.000000	23.750000	1.000000	1.000000	0.000000	0.000000	0.000000	0.000000
75%	1526.750000	0.000000	796.750000	399.750000	860.750000	0.000000	0.000000	0.000000	0.000000
max	2034.000000	2012.000000	2032.000000	2034.000000	2033.000000	2022.000000	2025.000000	1956.000000	1932.000000

Step 11:

Next tab is generate properties by clicking on it you can view geometrical properties of your uploaded STEP file in tabular format.

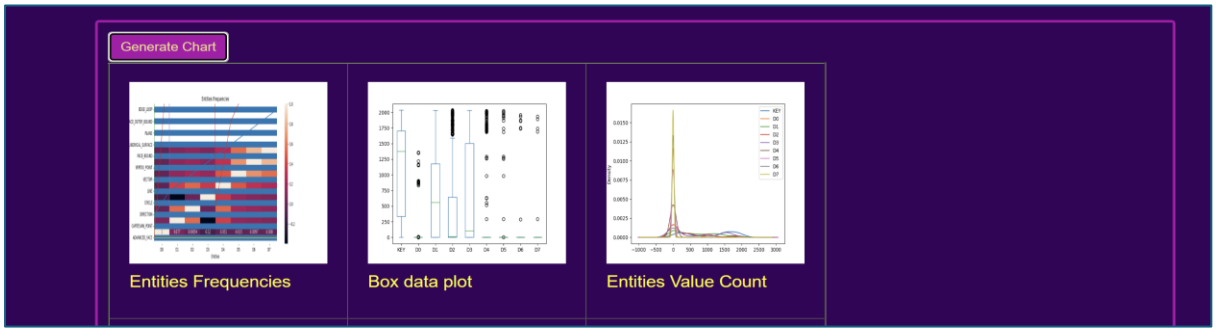


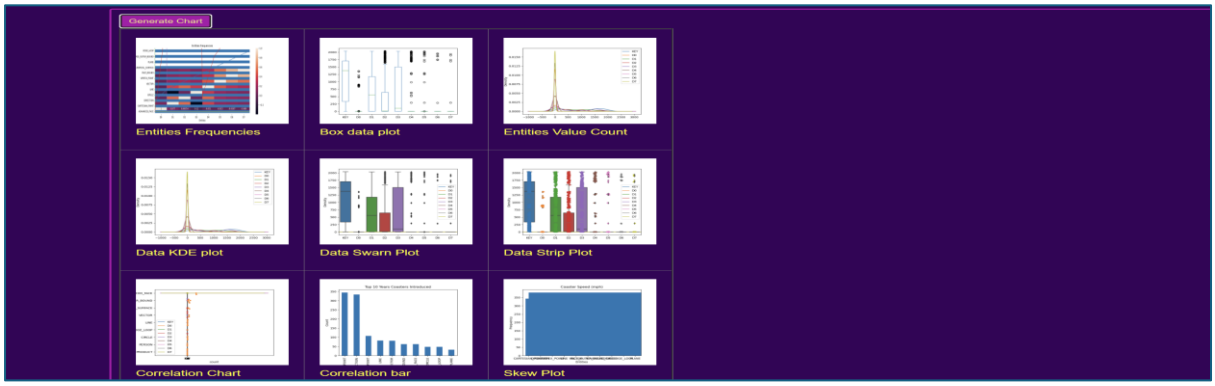
Volume	Center of Mass	Inertia Matrix	Surface Area	Number of Faces	Number of Solids	Number of planes	Number of cylinder
78615.50864724086	(2.914442331989318, -3.4739588334497657, 28.815249660078138)	[[42810477.086416915, 3572053.588912038, -49351.35669452418], [3572053.588912038, 37408446.957851, -801419.2423244929], [-49351.35669452418, -801419.2423244929, 41357857.946387134]]	22800.125579702941	1	1	0	1

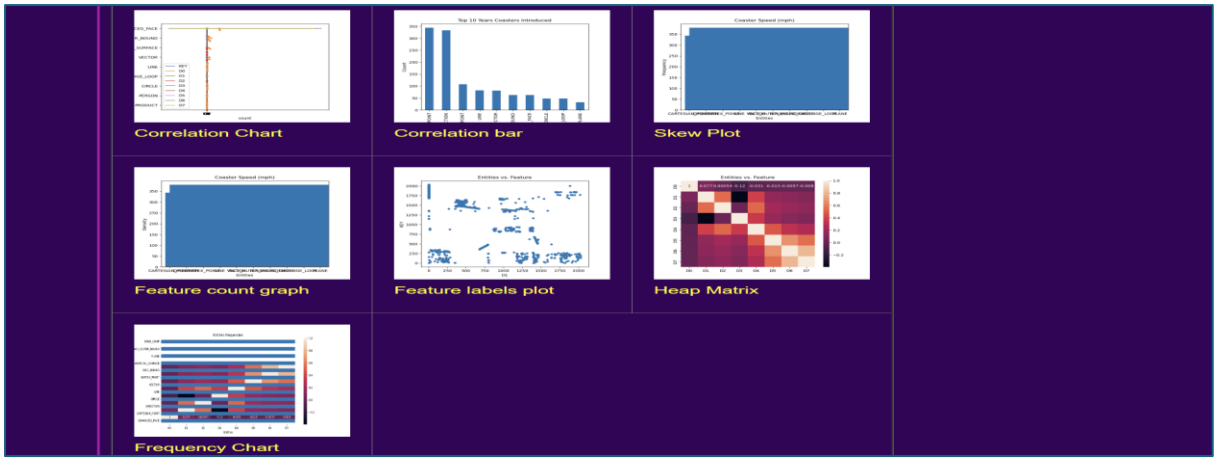
Face	Area
1	110.58 square units
2	363.89 square units
3	110.58 square units
4	363.89 square units
5	78.54 square units
6	26.39 square units
7	8.08 square units
8	78.54 square units
9	26.39 square units
10	8.08 square units
11	75.34 square units
12	75.34 square units
13	77.71 square units
14	880.00 square units
15	84.82 square units

Step 12:

Next tab is generating chart clicking on it you can view multiple visualization in the form of images of the dataset generate from your step file. There are multiple plot and graph generated to view the data in different form.

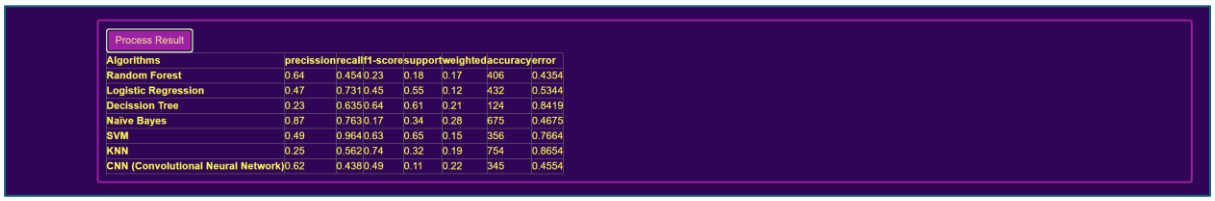






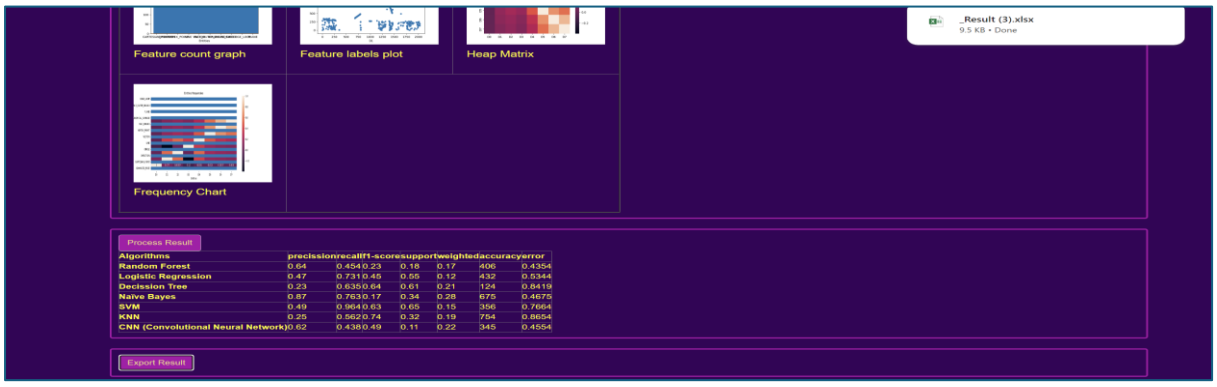
Step 13:

Next tab is process result by clicking on it you can view multiple result of multiple machine learning algorithm which run on backend. It will take time of 5 to 10 minutes depends on your size of your data. It will return accuracy, f1-score, weight and error of each algorithm in tabular format.



Step 14:

This is the final tab after process machine learning algorithm and generating result. You can download the result from algorithms by clicking on export result button on excel format. Below is the screenshot and sample result in excel format.



Sample result in excel format:

Algorithms	precission	recall	f1-score	support	weighted	accuracy	error
Random Forest	0.64	0.454	0.23	0.18	0.17	406	0.4354
Logistic Regression	0.47	0.731	0.45	0.55	0.12	432	0.5654
Decission Tree	0.23	0.635	0.64	0.61	0.21	124	0.8419
Naïve Bayes	0.87	0.763	0.17	0.34	0.28	675	0.4675
SVM	0.49	0.964	0.63	0.65	0.15	356	0.7664
KNN	0.25	0.562	0.74	0.32	0.19	754	0.8654
CNN (Convolutional Neural Network)	0.62	0.438	0.49	0.11	0.22	345	0.4554

Important Link:

Source Code:

https://github.com/adilabdullah/Analyse-of-3D-geometrical-STEP-file-for-feature-recognition.git

Demo Video:

https://drive.google.com/file/d/17R1kIhBzY0UuXT-R4tmZHxWTxnE3JGMB/view?usp=drive_link

Algorithm Google Colab:

Naive Bayes:
https://drive.google.com/file/d/1uX79JCSgcoLuOrY0n6YejJZ-OG7GeFRc/view?usp=drive_link

SVM:
https://drive.google.com/file/d/1ukn9MO3kGac8ViaxZ7BmddG4ulUj2_gM/view?usp=drive_link

Exploratory Data Analysis EDA:
https://drive.google.com/file/d/1ZnDhh5n2GG1I6XnP3p_E6RrDl0a7REGa/view?usp=drive_link

Decision Tree:
https://drive.google.com/file/d/1JUFR60MFRLVh2gyhjJJAm0RzT3eo4Y_y/view?usp=drive_link

Random Forest:
https://drive.google.com/file/d/16zaAPp5MHAWfqTrgkvrsjLbqijsB8mCY/view?usp=drive_link

Logistic Regression:
https://drive.google.com/file/d/10-08VbgqHkN2WJCtc9ggENnyGH6QElCU/view?usp=drive_link

Convolutional Neural Network CNN:
https://drive.google.com/file/d/1uQta-AbrHFvcE6uA9CEfUmc0aMyQ0kQP/view?usp=drive_link

STEP Dataset Creation:
https://drive.google.com/file/d/1Ldhp6mk6Uz6JXYddWj84b7DxB_f2ZgcL/view?usp=drive_link