AITOR

AITor

EDUCATION PLATFORM

A PERSONALIZED STUDENT
PERFORMANCE ANALYZER
AND RECOMMENDATION SYSTEM

2022-017

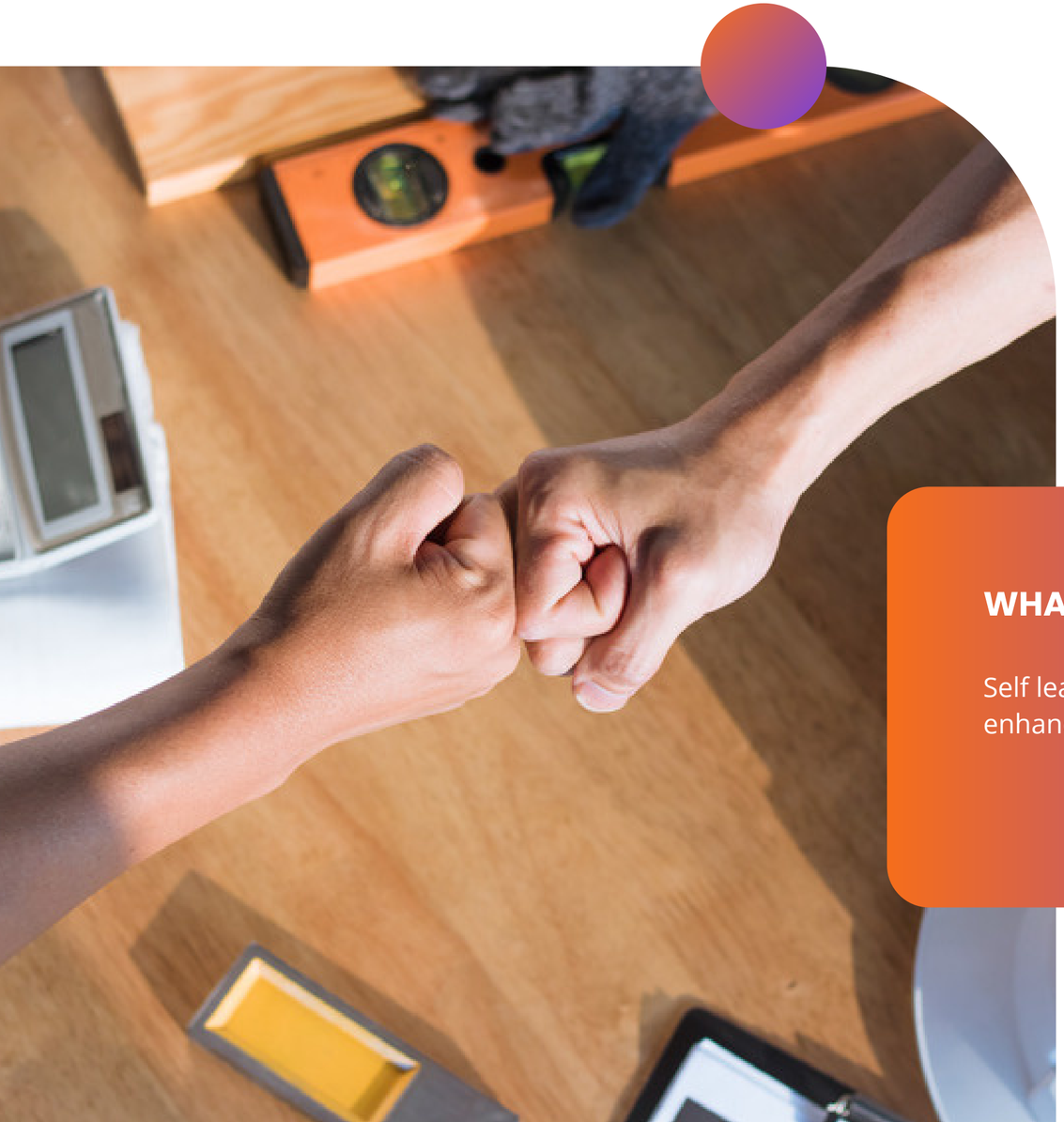
Meet Our Team

AKILA LIYANAGE
IT19120812

MAHENDRA THAMMITA
IT19120362

NETHSARA LIYANAGE
IT19188546

UDITHA JANADARA
IT19138114



PROJECT INTRODUCTION

WHAT WE ARE BUILDING

Self learning educational platform enhanced through Artificial Inteli

WHY WE ARE BUILDING THIS?

- Urged the demand for online education with the rise of COVID 19
- No specific way to statistically analyse the students perfomace in the distance learning procedure

RESEARCH PROBLEM

01 HOW TO INCREASE THE STUDENT ENGAGEMENT IN DISTANCE LEARNING?

02 HOW TO PROVIDE THE BEST LEARNING MATERIALS TO THE STUDENTS?

03 HOW TO ANALYZE THE STUDENT PERFORMANCE AND GENERATE A FULLY DETAILED REPORT?

04 HOW TO ALIGN STUDENTS WITH WHAT THEY ARE LEARNING AND WHAT THEY CAN BECOME ONCE THEY REACH THE INDUSTRY?

RESEARCH OBJECTIVE

Provide, **personalised** supportive learning environment to students with best **learning materials** and give tutors full **insight of the learning patterns of the students**

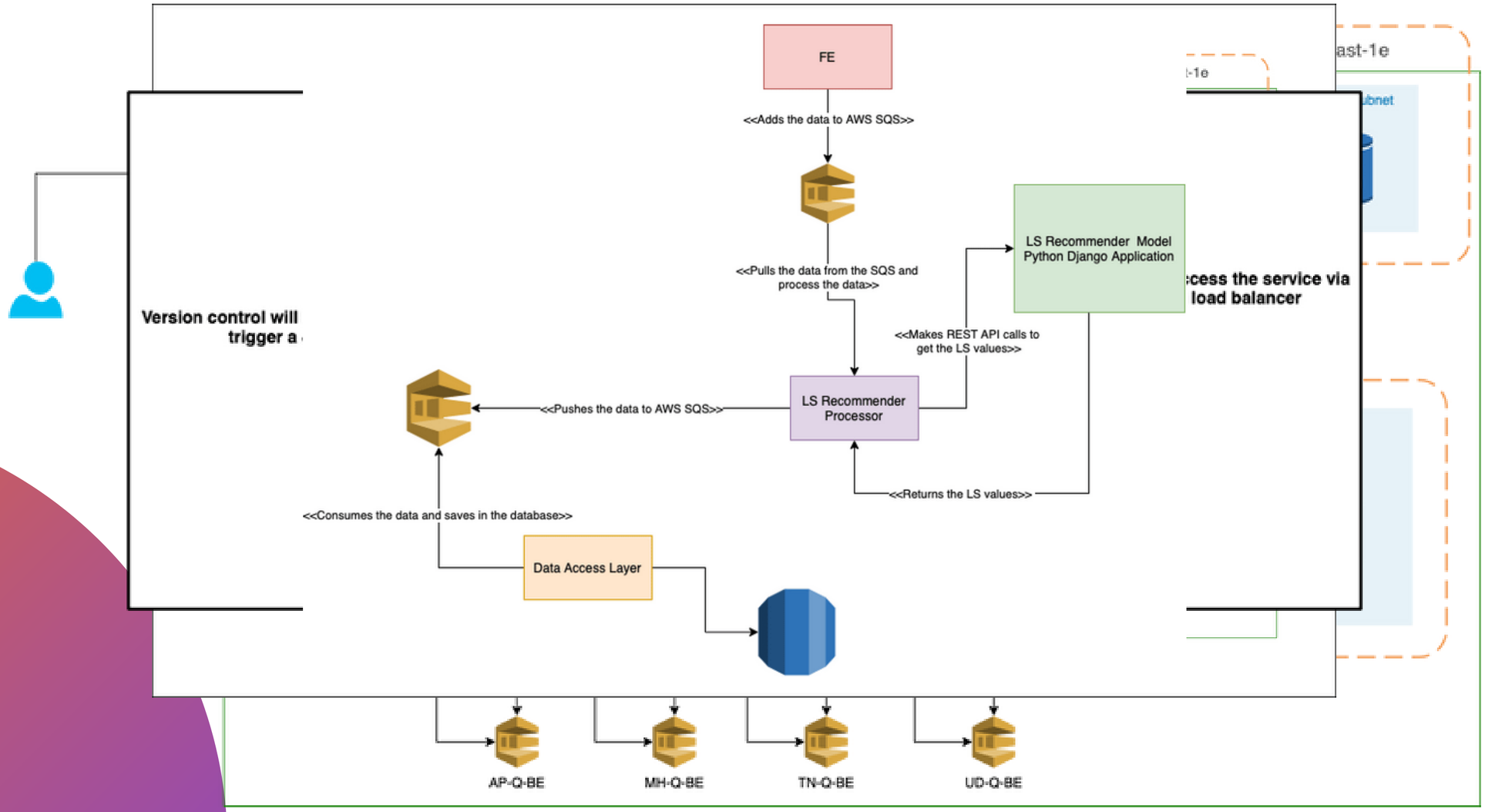
01 Identify and assign the students with their learning strategy

02 Recommend the best learning materials to the student

03 Analyze the student performance, forcast and generate a fully detailed report.

04 Student Skill Identification and Career recommendation

SYSTEM ARCHITECTURE



2022-017

LIYANAGE M.L.A.P.
IT19120812

FOCUSED AREA: Identifying and assign learning strategies of the students

SPECIALIZED IN SOFTWARE ENGINEERING

PROBLEM DEFINITION

01

IDENTIFY THE LEARNING STRATEGY OF THE STUDENT

02

FINE-TUNE THE IDENTIFIED LEARNING STRATEGY VARIABLE VALUES

HOW TO IDENTIFY THE LEARNING STRATEGY - PROOF OF CONCEPT

Look for what sort of learning strategy, students are using at the moment

Identify the core learning strategies

Get the initial user prefarance data from the user

Predict the LS percentages values

Train the data with the selected model

30%
Video

50%
Audio

20%
Text

01 Ideal Model Selection and Evaluation

02 Learning strategy identification algorithem creation

03 Initial data collection

04 Model training with defined model

05 Do necessary chnages to the model to get the desired output

Whats in the 50%

APPLICATION OF KEY PILLARS IN THE SPECIALISED AREA

01 Strategies used in selecting the specialised area

02 Why Clustering?

03 Algorithms available

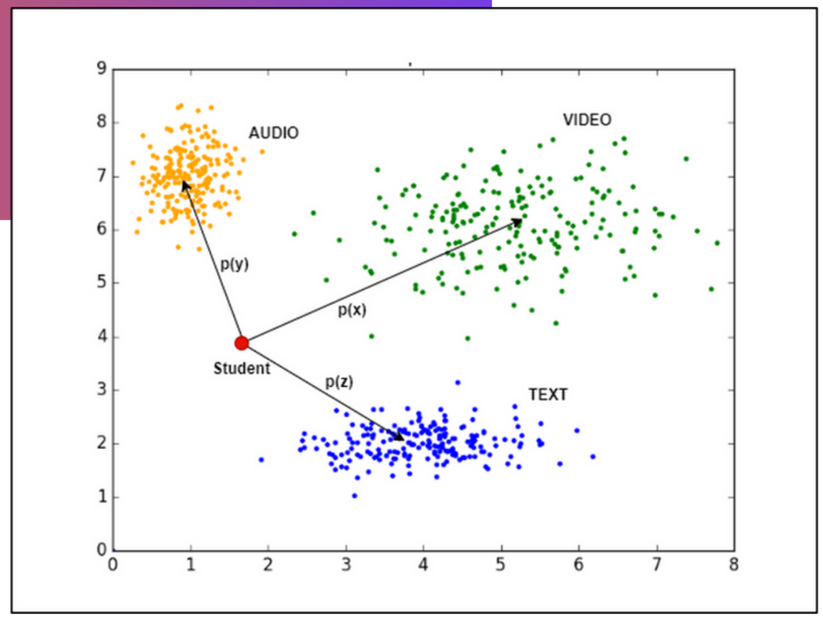
K-Means Clustering

Mean-Shift Clustering

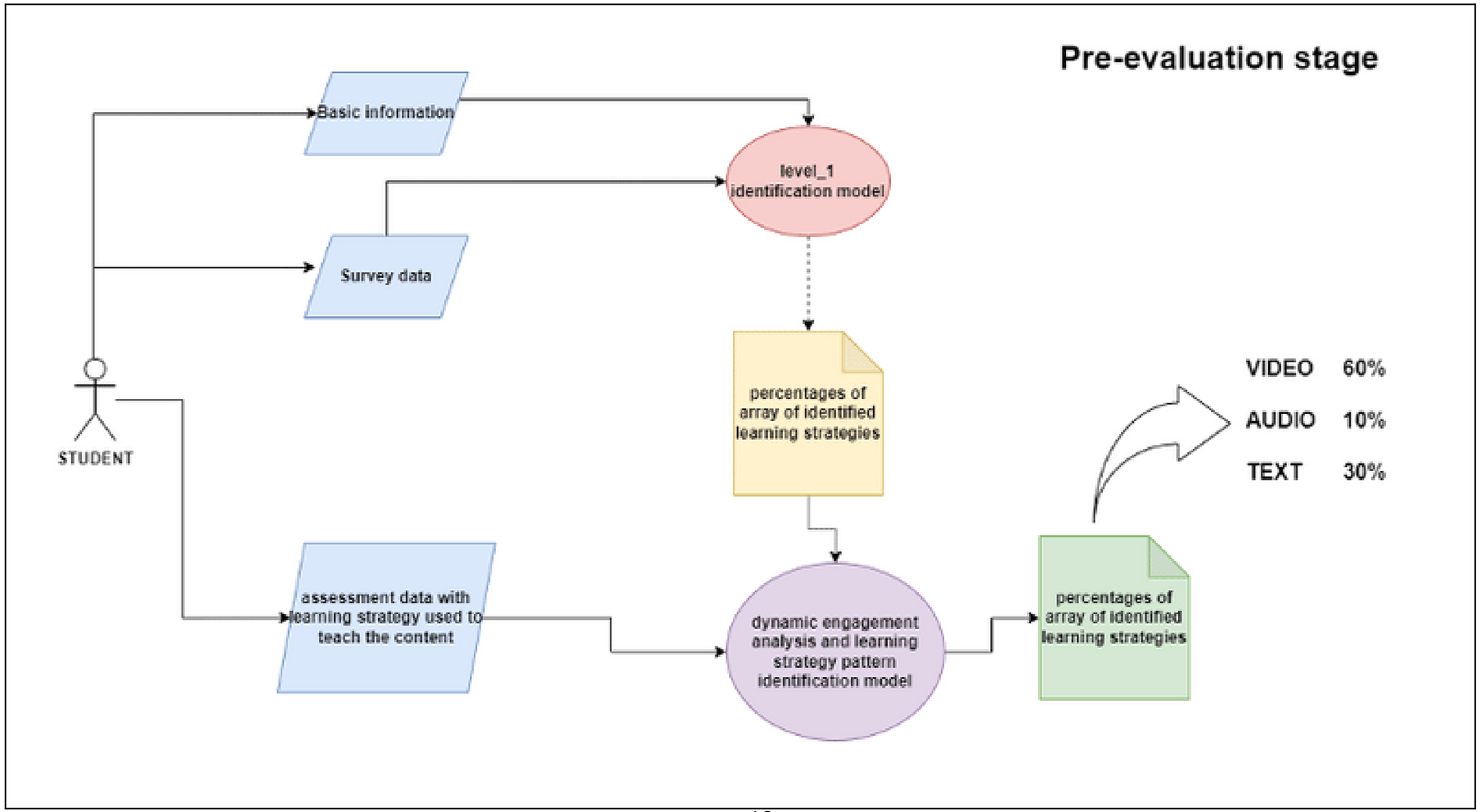
Expectation–Maximization (EM) Clustering using Gaussian Mixture Models (GMM)

DBSCAN

FUZZY-C MEANS CLUSTERING



USER FLOW IN HIGH LEVEL



EVIDENCES FOR THE COMPLETION

```
[ ]  1  df = pd.read_csv('https://aitor-train-data.s3.amazonaws.com/akila_train_new.csv').fillna(0)
```

```
[ ]  1  combined_da  Add code cell  lf.T.to_numpy()
     2  xpts = [com ⌘/Ctrl+M B   _new[0].astype(int)]
     3  ypts = [combined_data_new[1].astype(int)]
     4  print(ypts)
```

```
[array([ 4,  2,  6,  1,  3,  5,  0,  7,  4,  6,  3,  1, 10,  4,  3,  1,  5,
         3,  6,  0,  9,  6,  4,  1,  5,  7,  7,  7,  8,  1,  2,  2,  4,  6,
         6,  7,  6,  6,  1,  4,  1,  2,  5,  6,  0,  4,  2,  6,  7,  1,  4,
         8,  7,  6,  6,  5,  6,  5,  9,  9,  7,  3,  6,  2,  6,  0,  6,  3,
         3,  7,  0,  4,  2,  6,  7,  1,  4,  8,  7,  6,  6,  5,  6,  5,  9,
         9,  7,  3,  6,  2,  6,  0,  6,  3,  3,  7,  7,  4,  6,  3,  1, 10,
         4,  3,  1,  5,  3,  6,  0,  9,  6,  4,  1,  7,  4,  6,  3,  1, 10,
         4,  3,  1,  5,  3,  6,  0,  9,  6,  4,  1,  2,  6,  1,  3,  5,  0,
         7,  4,  6,  3,  1, 10,  4,  3,  1,  5,  3,  6,  0,  9,  6,  4,  1,
         5,  7,  7,  7,  8,  1,  2,  2,  4,  6,  6,  7,  6,  6,  1,  4,  1,
         2,  5,  6,  0,  4,  2,  6,  7,  1,  4,  8,  7,  6,  6,  5,  6,  5,
         9,  9,  7,  3,  6,  2,  6,  0,  6,  3,  3,  7,  0,  4,  2,  6,  7,
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         6,  3,  3,  7,  7,  4,  6,  3,  1, 10,  4,  3,  1,  5,  3,  6,  0,
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         9,  6,  4,  1,  2,  6,  1,  3,  5,  0,  7,  4,  6,  3,  1, 10,  4,
         3,  1,  5,  3,  6,  0,  9,  6,  4,  1,  5,  7,  7,  7,  8,  1,  2,
         2,  4,  6,  6,  7,  6,  6,  1,  4,  1,  2,  5,  6,  0,  4,  2,  6,
         7,  1,  4,  8,  7,  6,  6,  5,  6,  5,  9,  9,  7,  3,  6,  2,  6,
         0,  6,  3,  3,  7,  0,  4,  2,  6,  7,  1,  4,  8,  7,  6,  6,  5,
         6,  5,  9,  9,  7,  3,  6,  2,  6,  0,  6,  3,  3,  7,  7,  4,  6,
         3,  1, 10,  4,  3,  1,  5,  3,  6,  0,  9,  6,  4,  1,  7,  4,  6,
         3,  1, 10,  4,  3,  1,  5,  3,  6,  0,  9,  6,  4,  1]])]
```
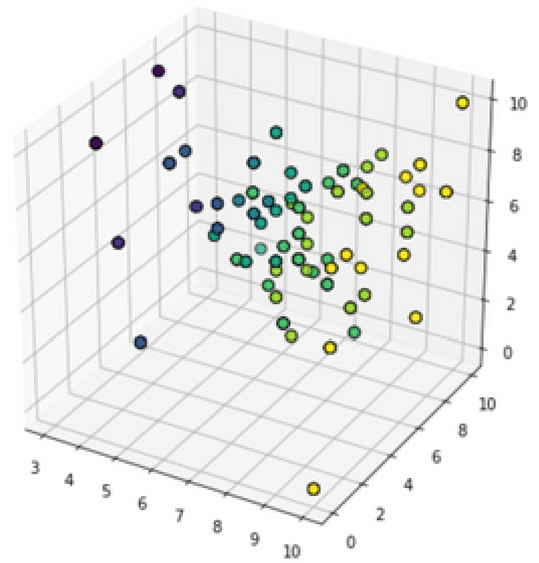

```
1  # Visualize the test data
2  colors = ['b', 'orange', 'g', 'r', 'c', 'm', 'y', 'k', 'Brown', 'ForestGreen']
3  labels = np.zeros(1)
4  fig = plt.figure(figsize=(7, 7))
5  ax = fig.add_subplot(111, projection='3d')
6  ax.scatter(combined_data_new[0].astype(int), combined_data_new[1].astype(int), combined_data_new[2].astype(int),
7             linewidths=1, alpha=.7,
8             edgecolor='k',
9             s = 50,
10            c=combined_data_new[0].astype(int))
```

```
<mpl_toolkits.mplot3d.art3d.Path3DCollection at 0x7fcb5c7cbd50>
```

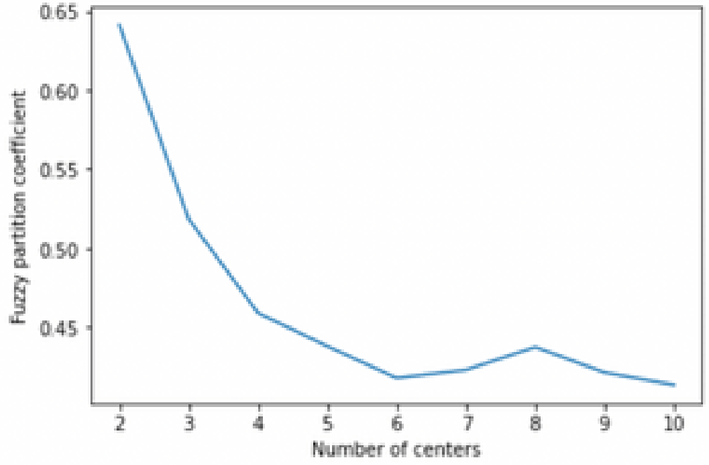


EVIDENCES FOR THE COMPLETION

```
fpcs = []
for i in range(2,11):
    cntr, u, u0, d, jm, p, fpc = fuzz.cluster.cmeans(combined_data_new, i, 2, error=0.005, maxiter=1000, init=None)
    fpcs.append(fpc)
```

```
fig2, ax2 = plt.subplots()
ax2.plot(np.r_[2:11], fpcs)
ax2.set_xlabel("Number of centers")
ax2.set_ylabel("Fuzzy partition coefficient")
```

```
Text(0, 0.5, 'Fuzzy partition coefficient')
```



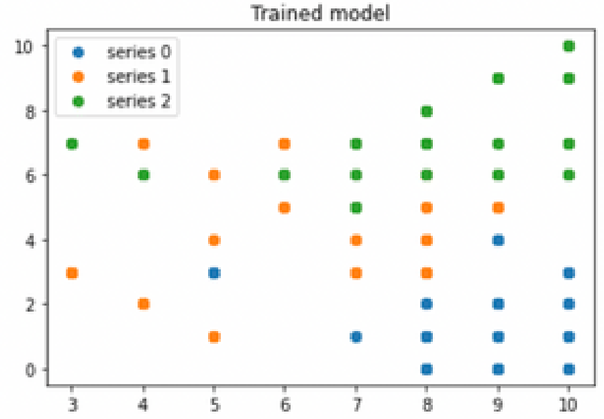
EVIDENCES FOR THE COMPLETION

```
1  cnter , u_orig , _ , _ , _ , _ , _ = fuzz.cluster.cmeans(combined_data_new , 3 , 2 , error=0.005 , maxiter=1000)
2  print(cnter)
```

```
[[8.58033421 1.81229136 7.4920698 ]
 [7.27381637 4.71988479 5.67932412]
 [8.28011788 6.6967631  7.46555968]]
```

```
1  # Show 3-cluster model
2  fig2, ax2 = plt.subplots()
3  ax2.set_title('Trained model')
4  for j in range(3):
5      ax2.plot(combined_data_new[0, u_orig.argmax(axis=0) == j],
6               combined_data_new[1, u_orig.argmax(axis=0) == j], 'o',
7               label='series ' + str(j))
8  ax2.legend()
```

```
<matplotlib.legend.Legend at 0x7fcb57f2da50>
```



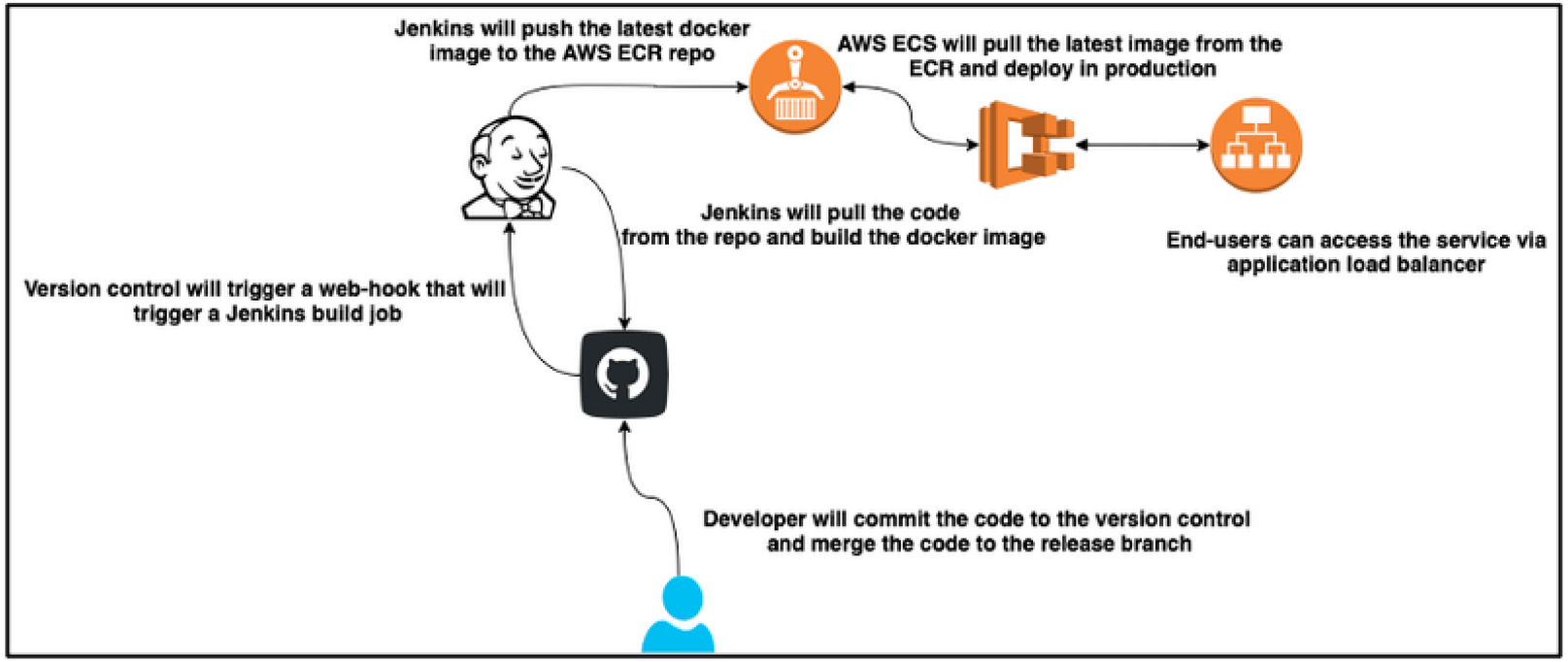
STUDIO SHODWE

Usage of technologies in the relevant key pillar/area

COMPONENT/MODULE	TECHNIQUES	RULES AND ALGORITHEMS	TECHNOLOGIES
LS Recomender model	Clustering	Fuzzy-C Means	Python, Scikit-learn, Pandas, Numpy, Django, Pickle, Skfuzzy
User Interfaces	UI/UX		Figma, ReactJs

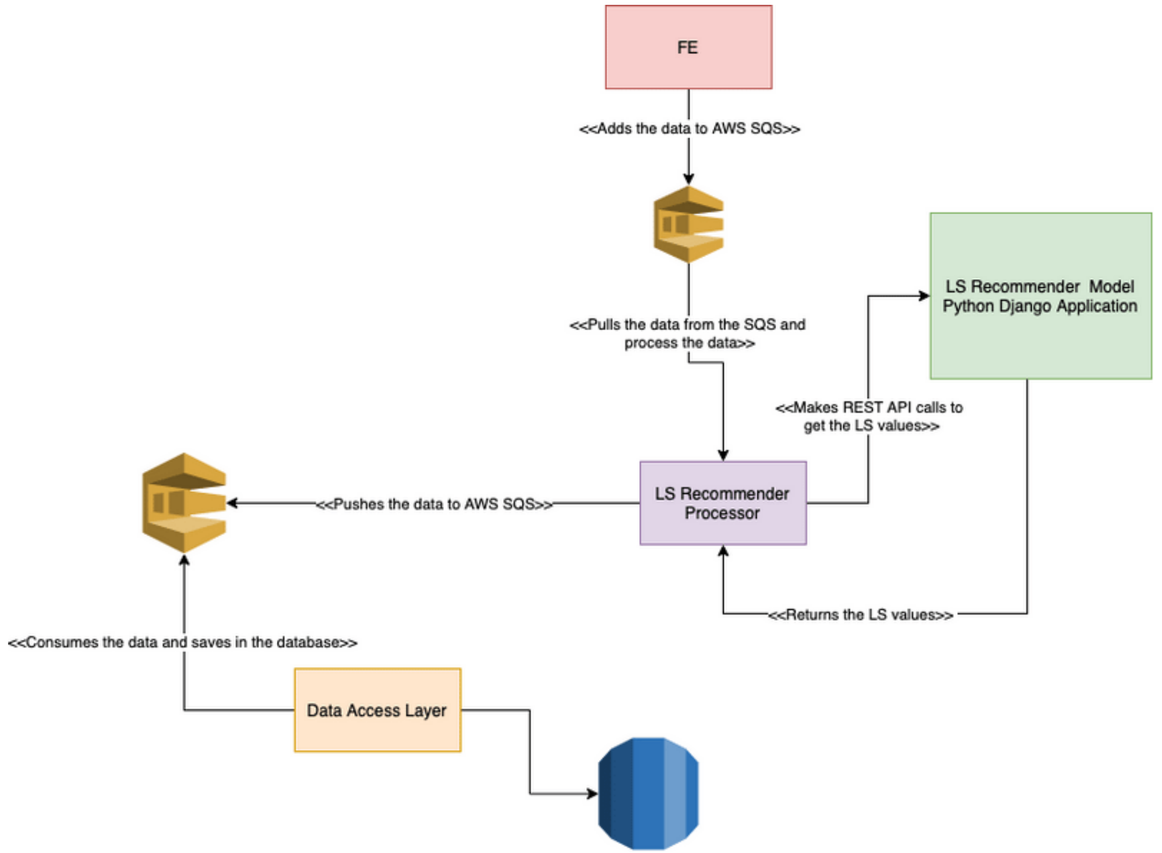
DESIGN EXCELLENCE AND BEST PRACTICES FOLLOWED

- Entire architecture will follow micro-services topology
- Proposed feature will be developed/ has been developed as fully cloud native manner



STANDERD BEST PRACTICES

- It has been identified that, with the increment of the registrations, the number of users using the LS recommender feature will be in high demand
- Application will be de-coupled by using message queues
- Application will be/has been structuerd to adopt to full DevSecOps methodologies

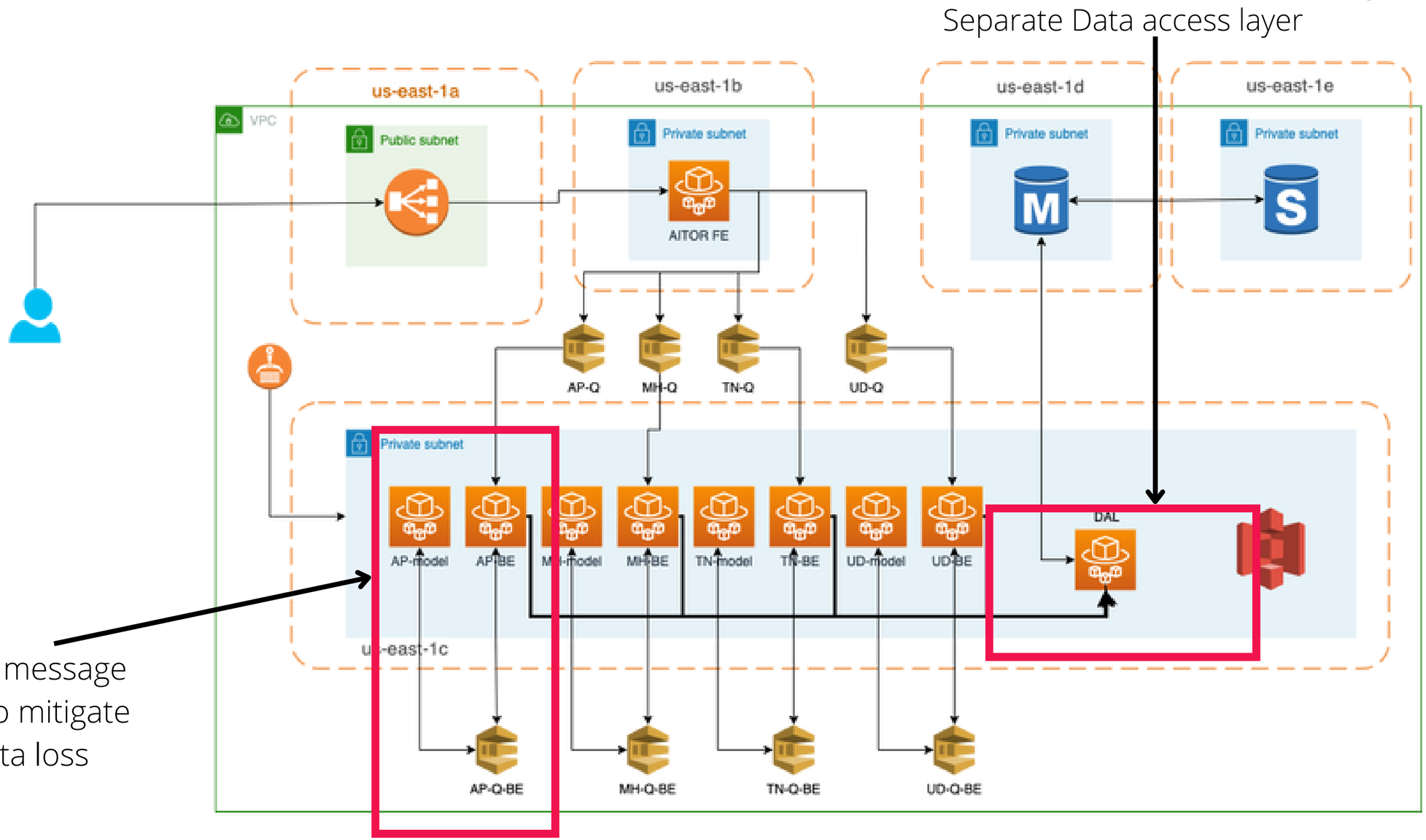


USER/FUNCTIONAL REQUIREMENTS

- **Functional Requirements**
  - Successful identification of each student's learning strategy
  - Allocation/fine tuning of identified LS values of each student

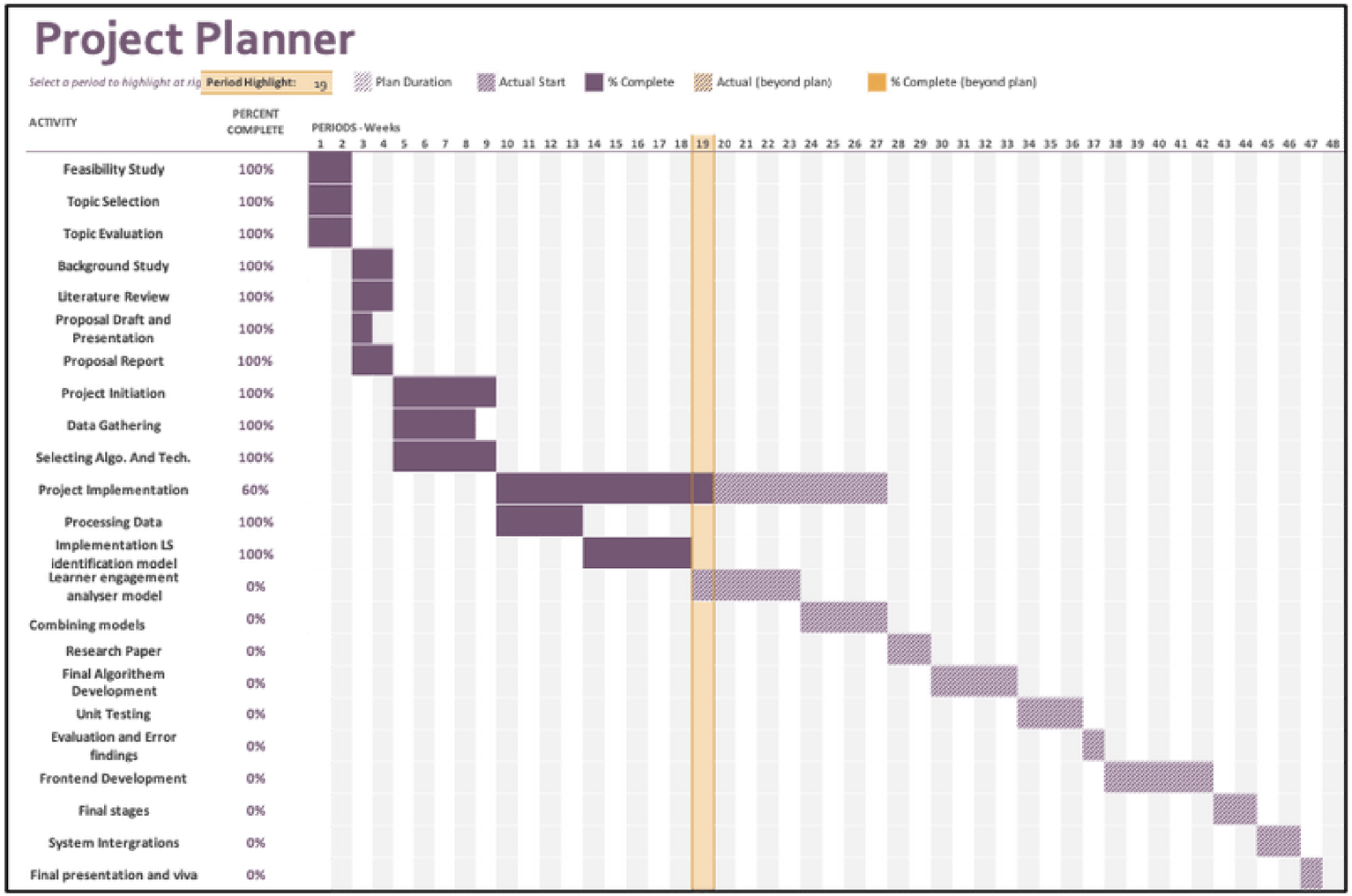
- **Non functional requirements**
  - Students should be able to access the application from anywhere in the world
  - Students/Tutors should be able to easily afford the application without paying much on featuers

RISK MITIGATION

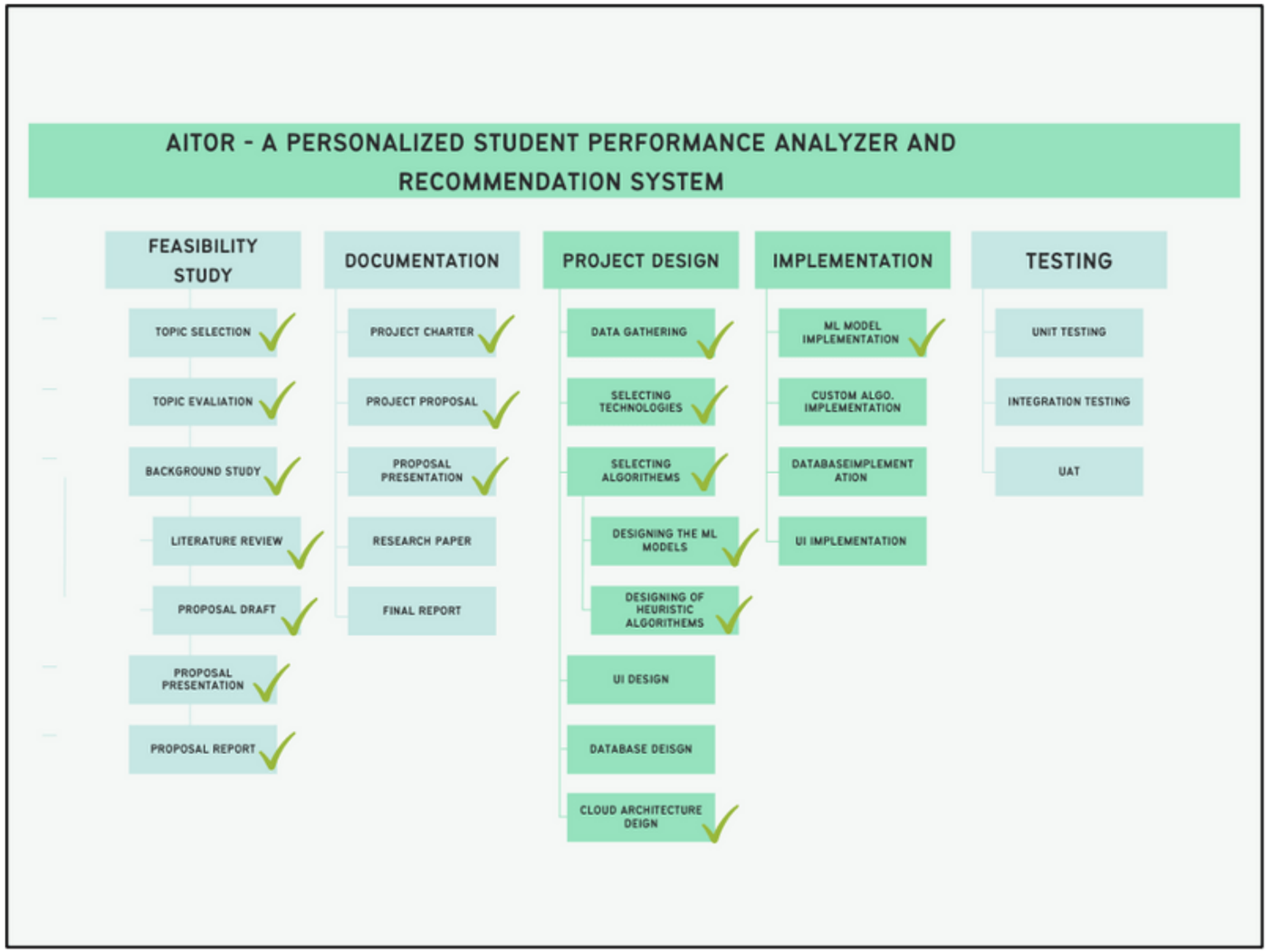


Usage of message queues to mitigate the data loss

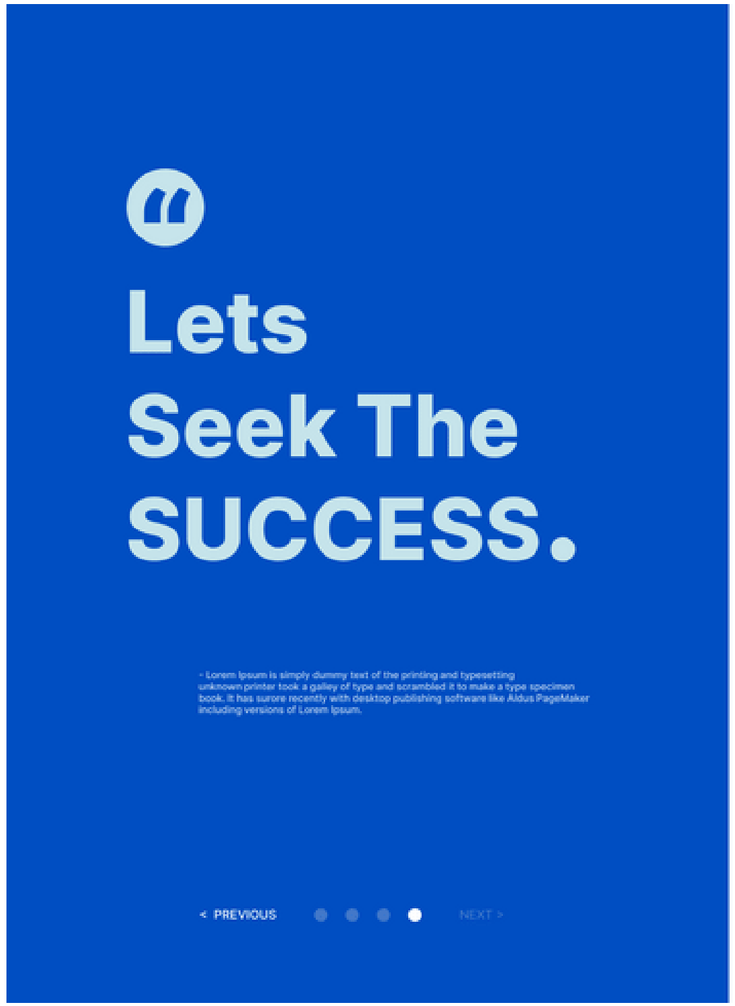
PROJECT GANATT CHART

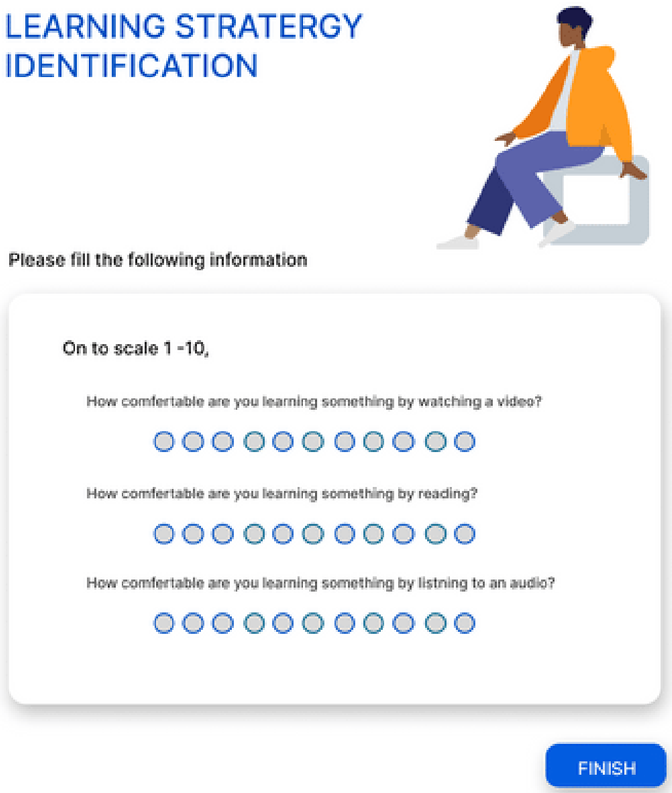


WORK BREAKDOWN CHART



DEMONSTRATION





Thammita D.H.M.M.P
IT19120362

FOCUSED AREA: Identification and recommendation of best-suited learning materials based on learning style and personal preferences.

SPECIALIZED IN SOFTWARE ENGINEERING

PROBLEM DEFINITION

01 IDENTIFY KEY LEARNING AREAS

02 LEARNING MATERIAL RECOMMENDATION BASED ON PERSONAL PREFERENCE AND LEARNING STYLE

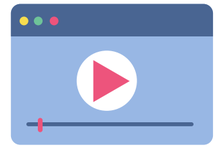
03 FINETUNE LEARNING MATERIAL RECOMMENDATIONS

HOW TO RECOMMEND LEARNING MATERIALS- PROOF OF CONCEPT

EXTRACT KEY LEARNING AREAS BY SUBJECT OUTLINE

COLLECT AUDIO, VIDEO AND TEXT LEARNING MATERIALS AND UPDATE DATASETS

RECOMMEND LEARNING MATERIALS



30%
Video

50%
Audio

20%
Text

LEARNING STYLE

COLLECT USER RATINGS ON RECOMMENDED LEARNING MATERIALS

RE-TRAIN AND CALCULATE USER SIMILARITY

01 Ideal Model Selection and Evaluation

02 Key Learning Areas Identification Model Implementation

03 Learning Material Recommendation Algorithm Implementation

04 Implementation of Connection to the YouTube Data API and initial data collection

05 Video-based Learning material Recommendation function implementation

Whats in the 50%

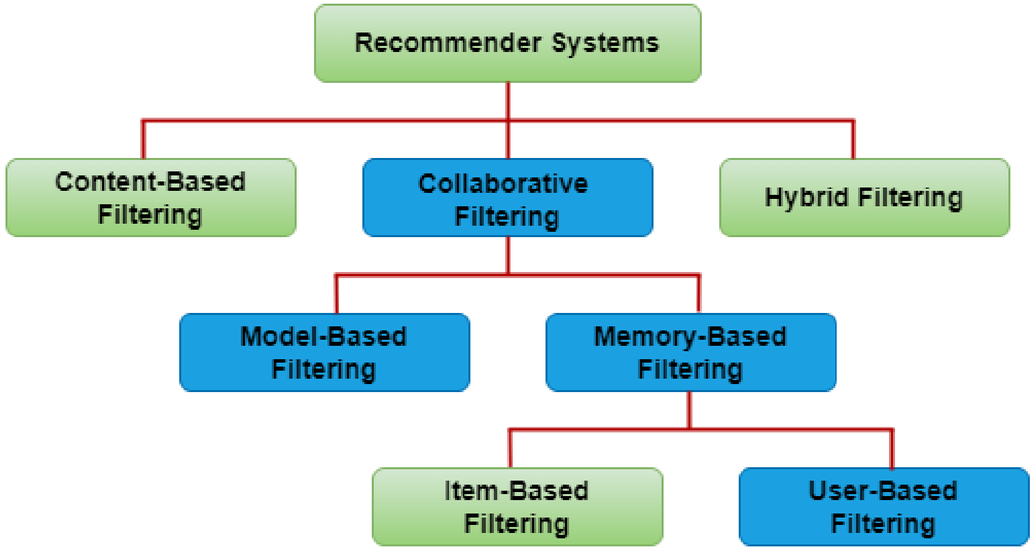
APPLICATION OF KEY PILLARS IN THE SPECIALISED AREA

NEAREST NEIGHBOUR COLLABORATIVE FILTERING – USER-BASED COLLABORATIVE FILTERING

01 Why Collaborative filtering over content-based filtering?

02 Why User-Based Collaborative filtering over Item-Based Collaborative filtering?

03 What Used in Implementation



APPLICATION OF KEY PILLARS IN THE SPECIALISED AREA

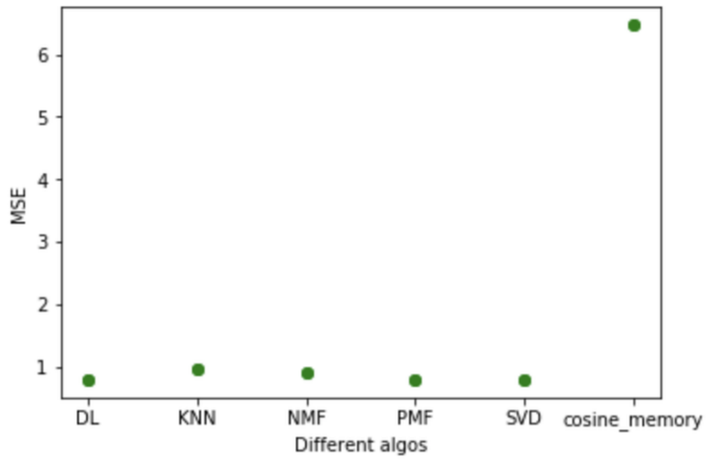
SVD – SINGULAR VALUE DECOMPOSITION

01 **Different Implementations in Model-Based Filtering**

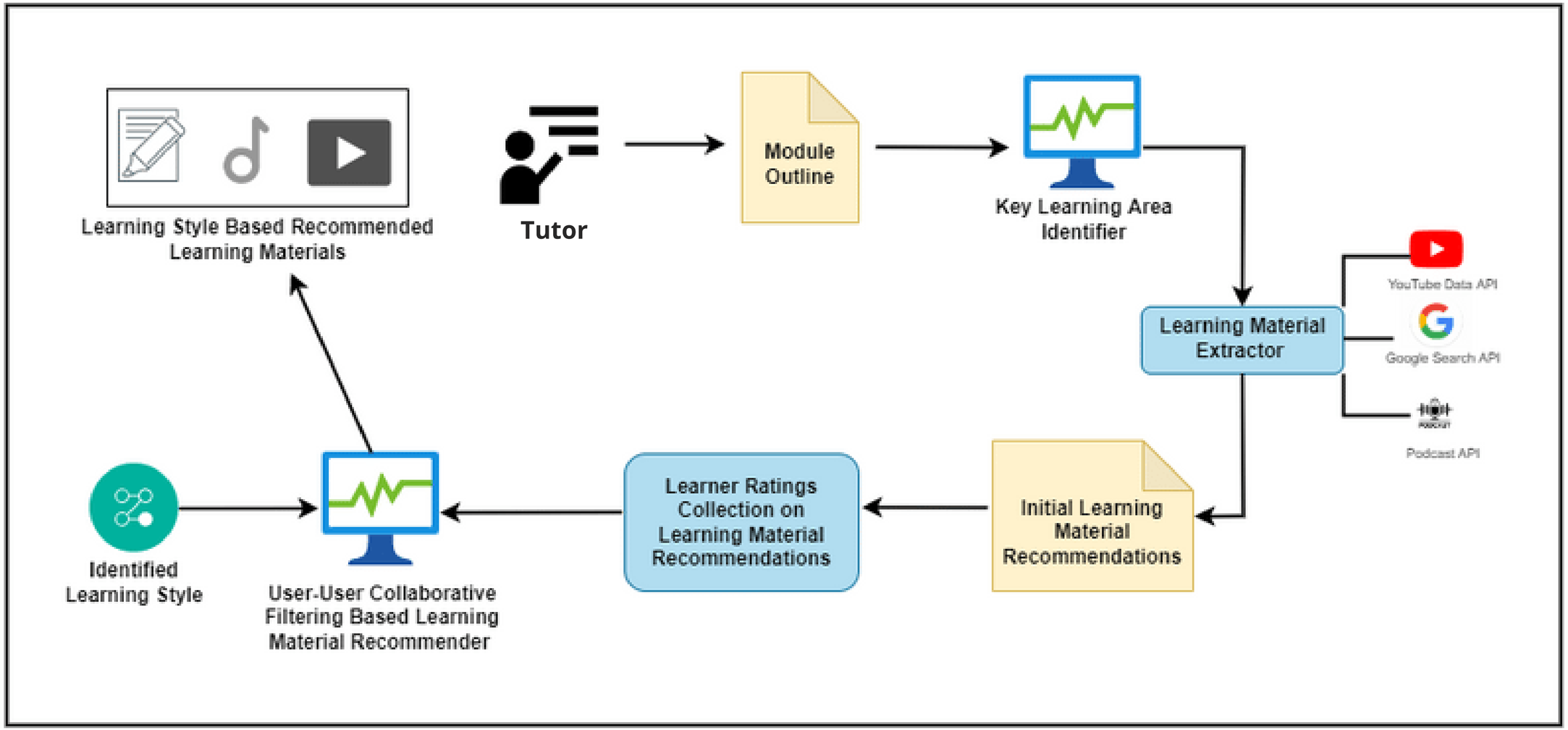
- SVD
- KNN
- Matrix Factorization
- Multi layerd neural networks

02 **What is the best implementation?**

02 **Why SVD?**

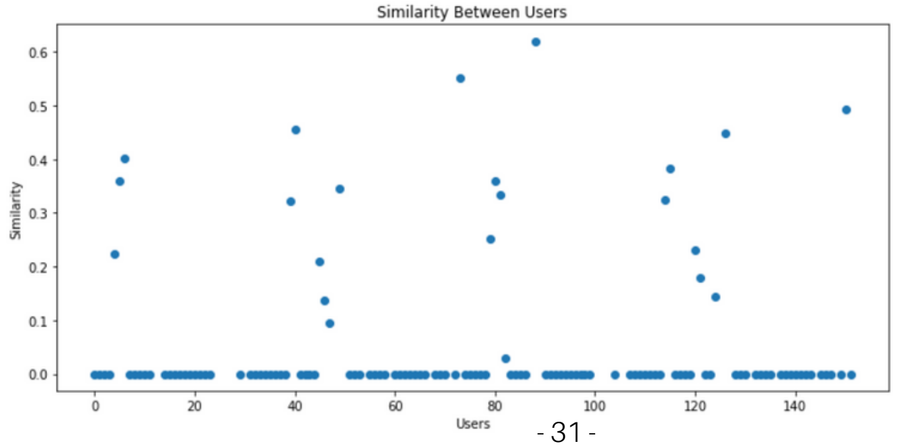


USER FLOW IN HIGH LEVEL



EVIDENCES FOR THE COMPLETION

```
# create a df of just the current user
user1 = rating_matrix[rating_matrix.index == current_user]

# and a df of all other users
other_users1 = rating_matrix[rating_matrix.index != current_user]

# calc cosine similarity between user and each other user
similarities = cosine_similarity(user1,other_users1)[0].tolist()

 # create list of indices of these users
indices = other_users1.index.tolist()

# create key/values pairs of user index and their similarity
index_similarity = dict(zip(indices, similarities))

import matplotlib.pylab as plt

lists = sorted(index_similarity.items()) # sorted by key, return a list of tuples


x, y = zip(*lists) # unpack a list of pairs into two tuples

plt.figure(figsize=(10,5))
plt.scatter(x, y)
plt.xlabel('Users')
plt.ylabel('Similarity')
plt.title('Similarity Between Users')
plt.tight_layout()
plt.show()
```



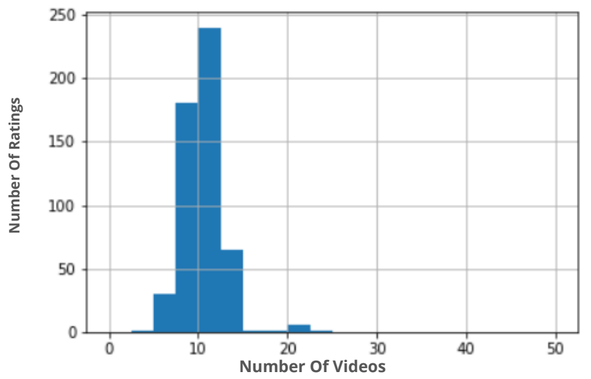
EVIDENCES FOR THE COMPLETION

```
# Use the famous SVD algorithm
algo = SVD()

# Run 5-fold cross-validation and then print results
cross_validate(algo, data, measures=['RMSE', 'MAE'], cv=5, verbose=True)
```

```
Evaluating RMSE, MAE of algorithm SVD on 5 split(s).

                  Fold 1  Fold 2  Fold 3  Fold 4  Fold 5  Mean    Std
RMSE (testset)    2.0349  2.0107  2.0525  2.0766  2.0928  2.0535  0.0292
MAE (testset)     1.7469  1.7099  1.7669  1.7835  1.7984  1.7611  0.0309
Fit time          0.25    0.26    0.25    0.26    0.26    0.26    0.01
Test time         0.01    0.01    0.01    0.01    0.01    0.01    0.00
```

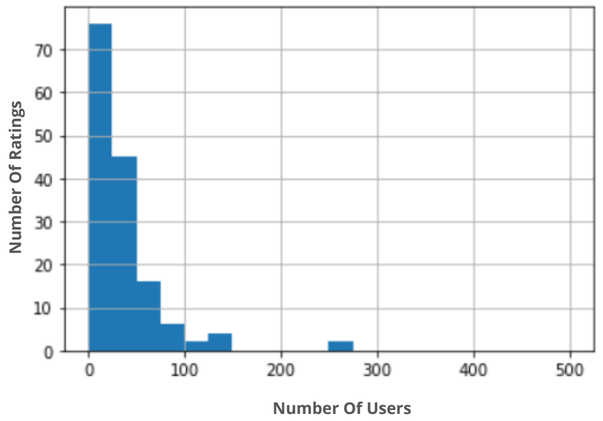
```
# distribution of ratings per anime
ratings_per_video.hist(bins=20, range=(0,50))
```

```
<AxesSubplot:>
```




```
# distribution of ratings per user
ratings_per_user.hist(bins=20, range=(0,500))
```

```
<AxesSubplot:>
```



USER/FUNCTIONAL REQUIREMENTS

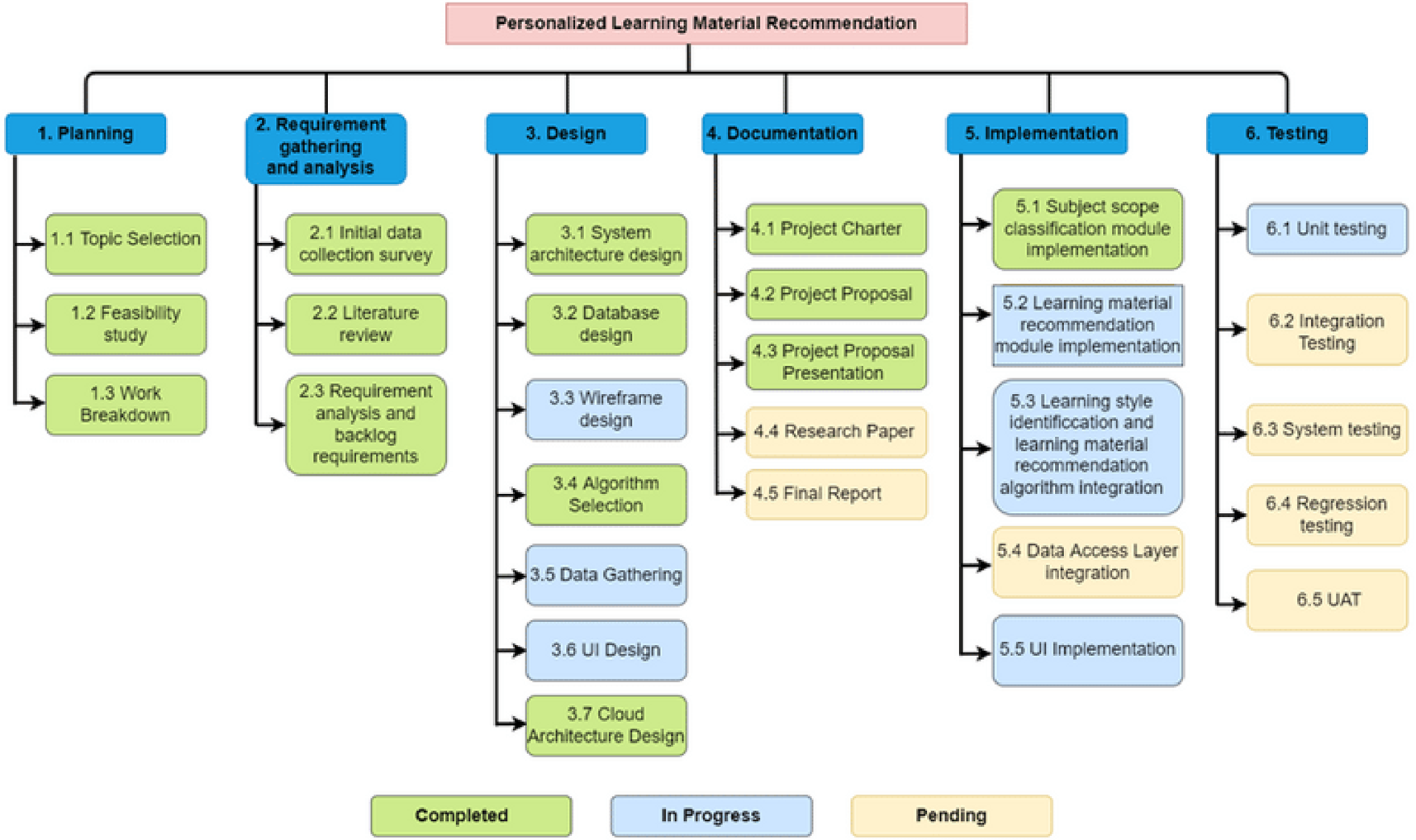
- **Functional Requirements**
  - Suggest Learning materials that align with the learning styles of the user.
  - Identify key learning areas through learning outlines
  - Continuously fine-tune and adjust learning material recommendations according to the learning style.

- **Non-functional requirements**
  - Students should be able to freely access the recommended learning materials
  - Ensure thehigh availability of recommended items

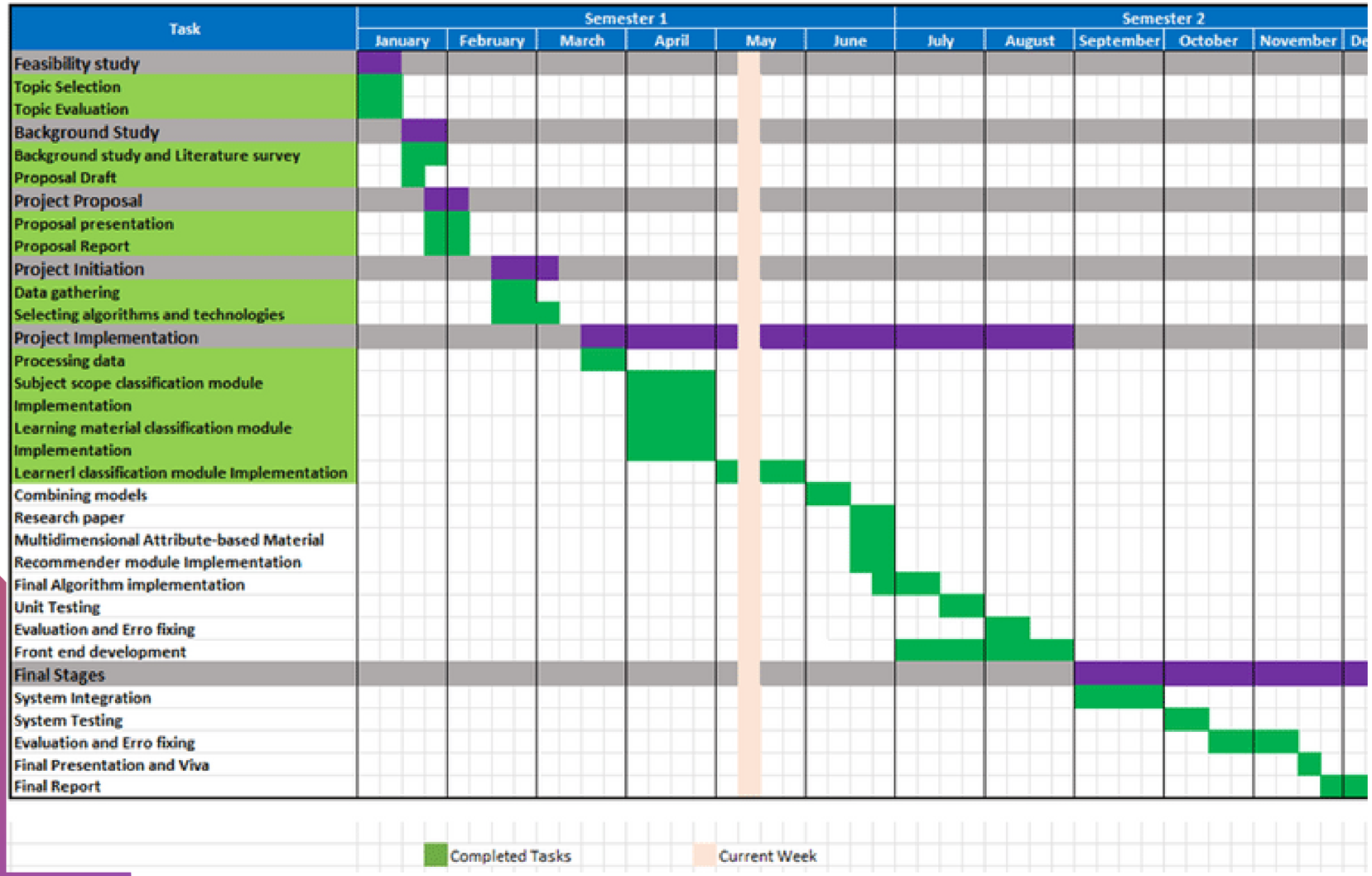
Usage of technologies in the relevant key pillar/area

COMPONENT/MODULE	TECHNIQUES	RULES AND ALGORITHEMS	TECHNOLOGIES
Learning Material Recommender Model	Collaborative Filtering	SVD & Cosine Similarity	Python, Scikit-learn, Pandas, Numpy, Django, Surprise
Filtering Keyword Identifier	Information Extraction	RNN	Python, Scikit-learn, Pandas, Numpy, Django, Keras, Tensorflow

Work Breakdown Structure



Project Gantt Chart



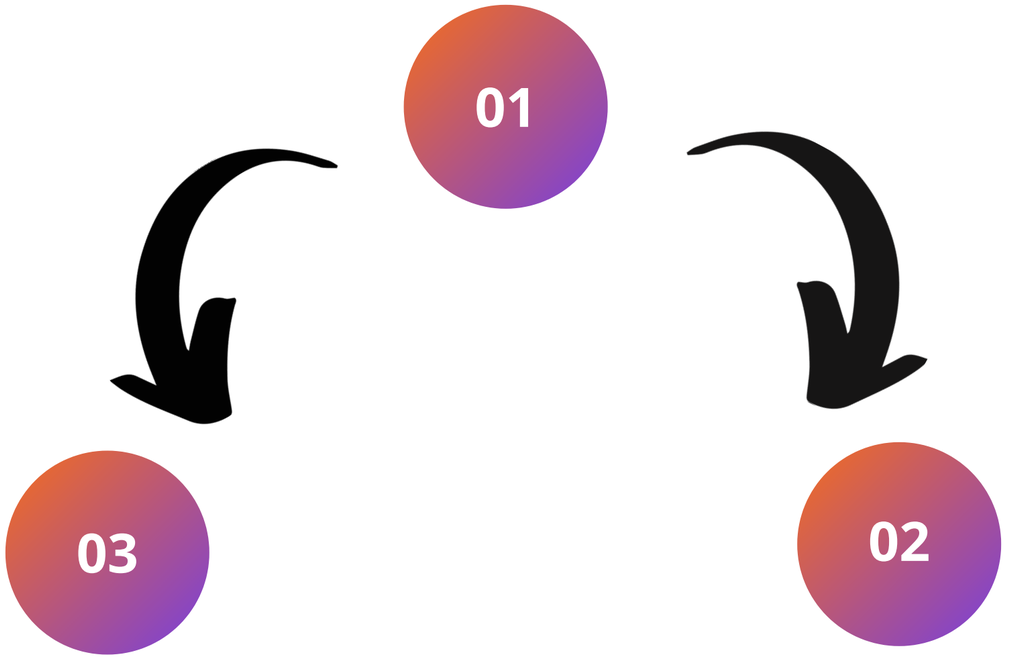
HIRIMUTHUGODA UJ
IT19138114

FOCUSED AREA: Student skill identification and career recommendation

SPECIALIZED IN SOFTWARE ENGINEERING

PROBLEM DEFINITION

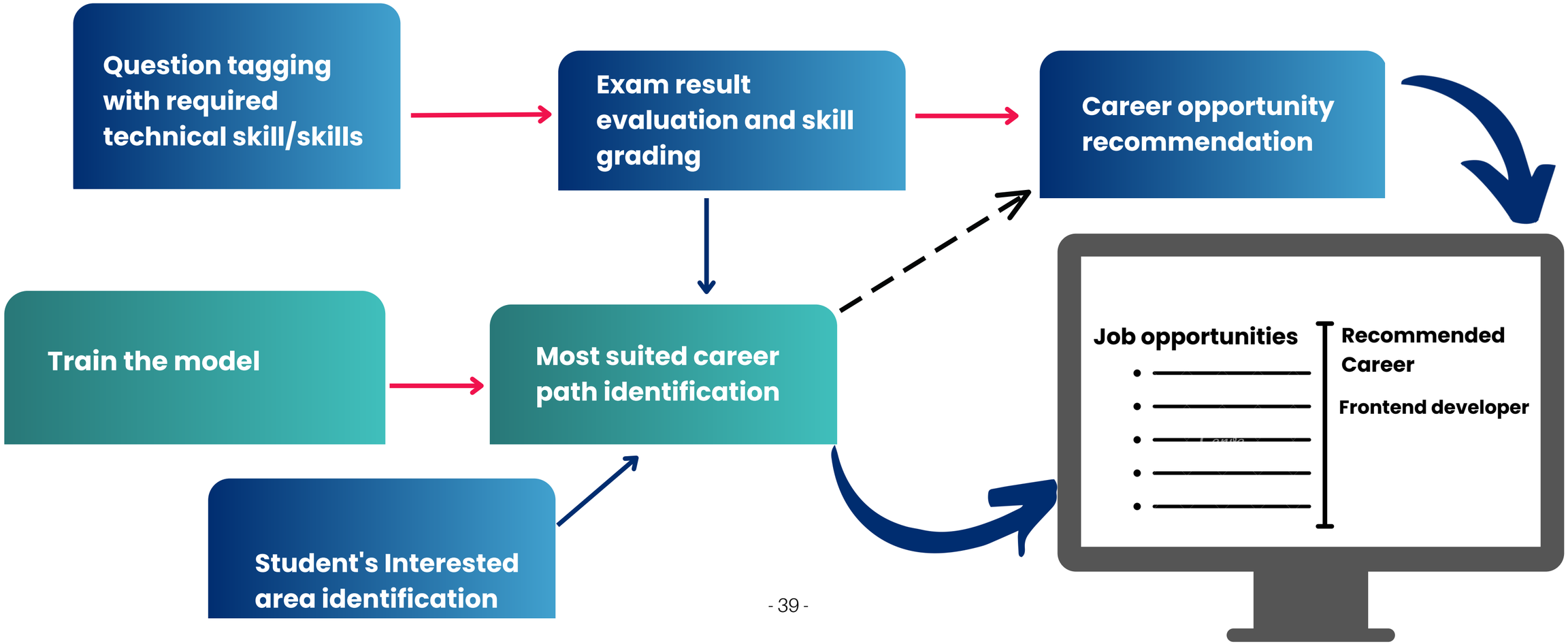
Student skill identification



Career opportunity recommendaton

Career path recommendation

Skill Identification and Career opportunity recommendation - PROOF OF CONCEPT



01 Skill extraction from job postings

02 Most suitable job opportunities filtering

03 Career recommendation model

04 Initial UI implementation

Whats in the 50%

APPLICATION OF KEY PILLARS IN THE SPECIALISED AREA

01 Why Linear SVM over Naive Bayes

02 Text classification

03 Jaccard similarity

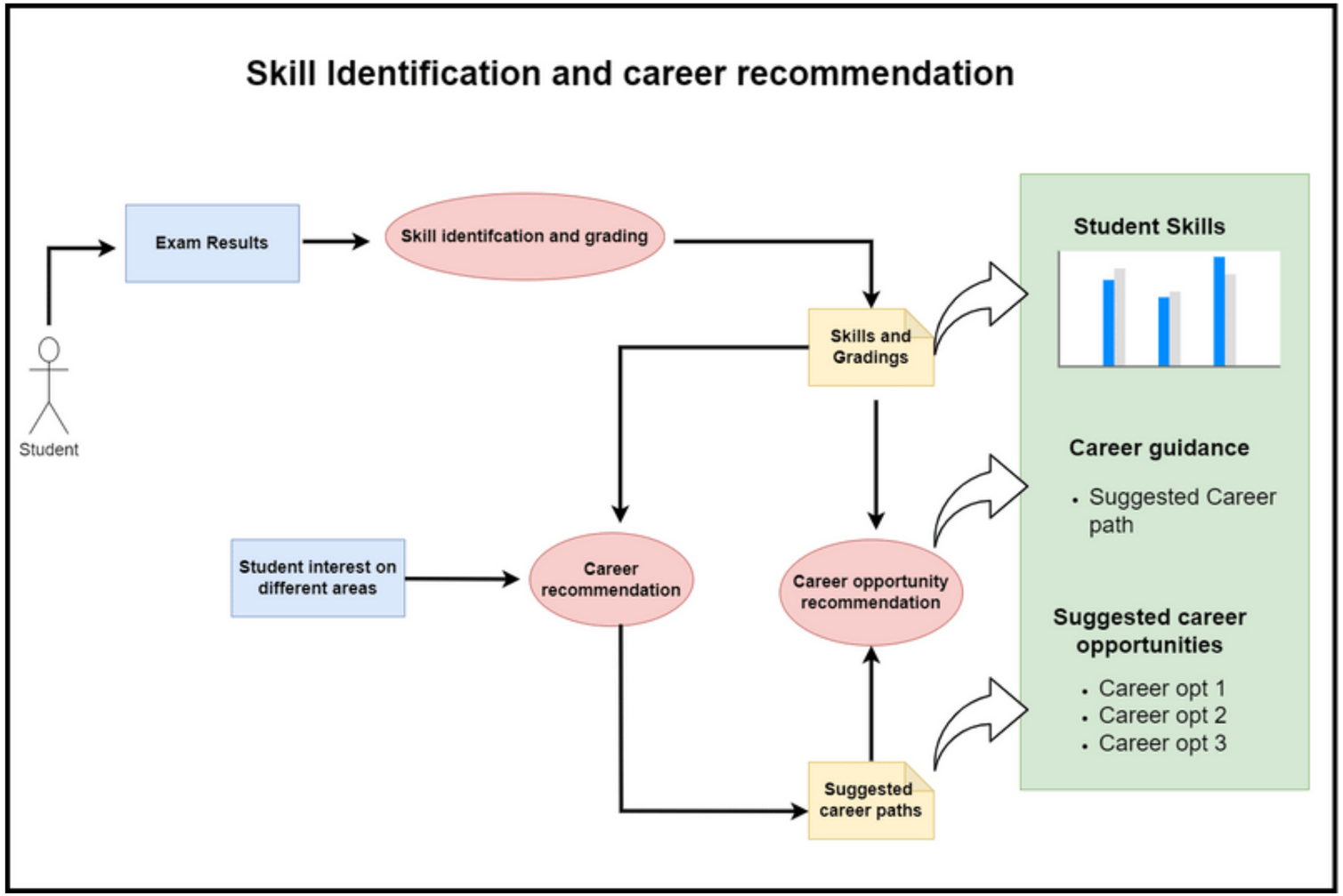
Perform well in multi-class classification

Look for interaction between the features

Descriptive input on the student can be used to get the most accurate outcome

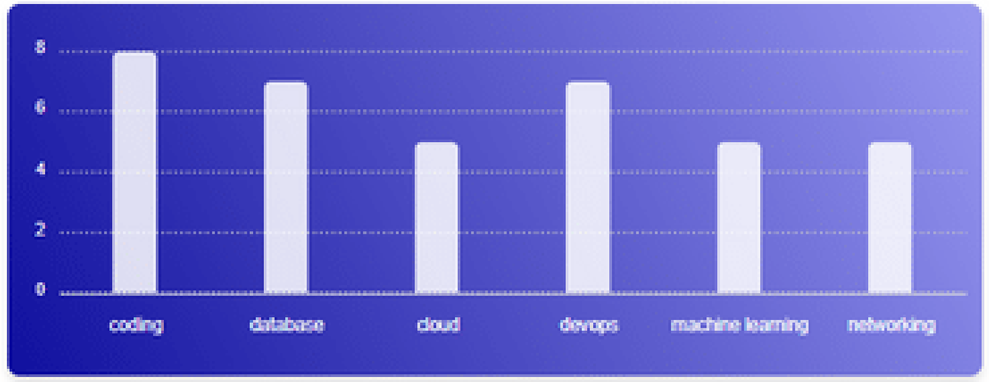
Compare similarity between job posting skill and student skills

USER FLOW IN HIGH LEVEL



EVIDENCES FOR THE COMPLETION

Performance Chart



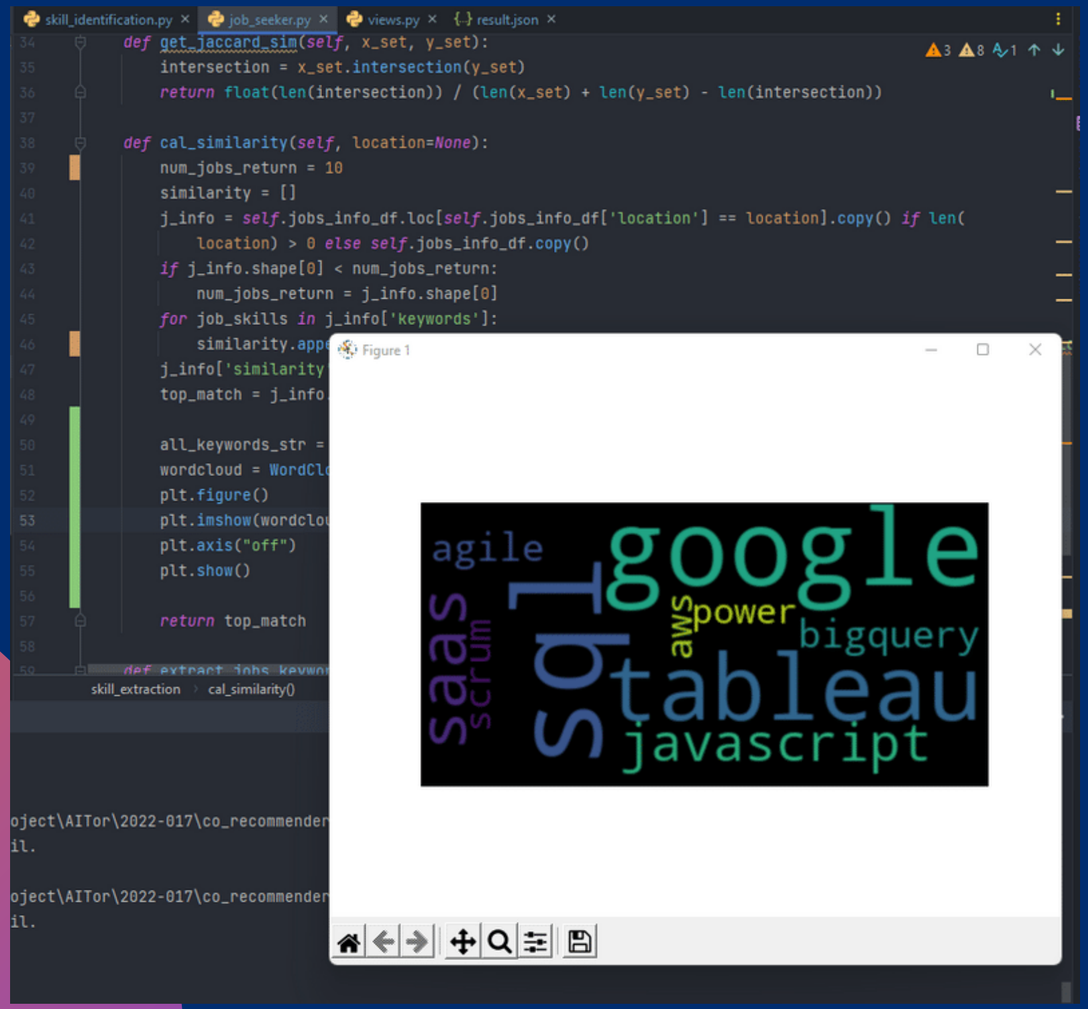
Suggested career: Web Developer

- Frontend developer
- backend Developer
- Full stack developer

Current job openings

- **Senior Software Developer - Data Team**
  Granify
- **Coop Work Experience Student - System Analyst / Data Analyst**
  Alberta Health Services
- **Data Analyst (3 Month Contract)**
  Robert Half Technology
- **Data Engineer**
  Dotdash
- **Data Analyst (3 Month Contract)**
  Robert Half Technology
- **Data Scientist**
  Granify
- **Data Analyst**
  T.D. Williamson, Inc.

EVIDENCES FOR THE COMPLETION



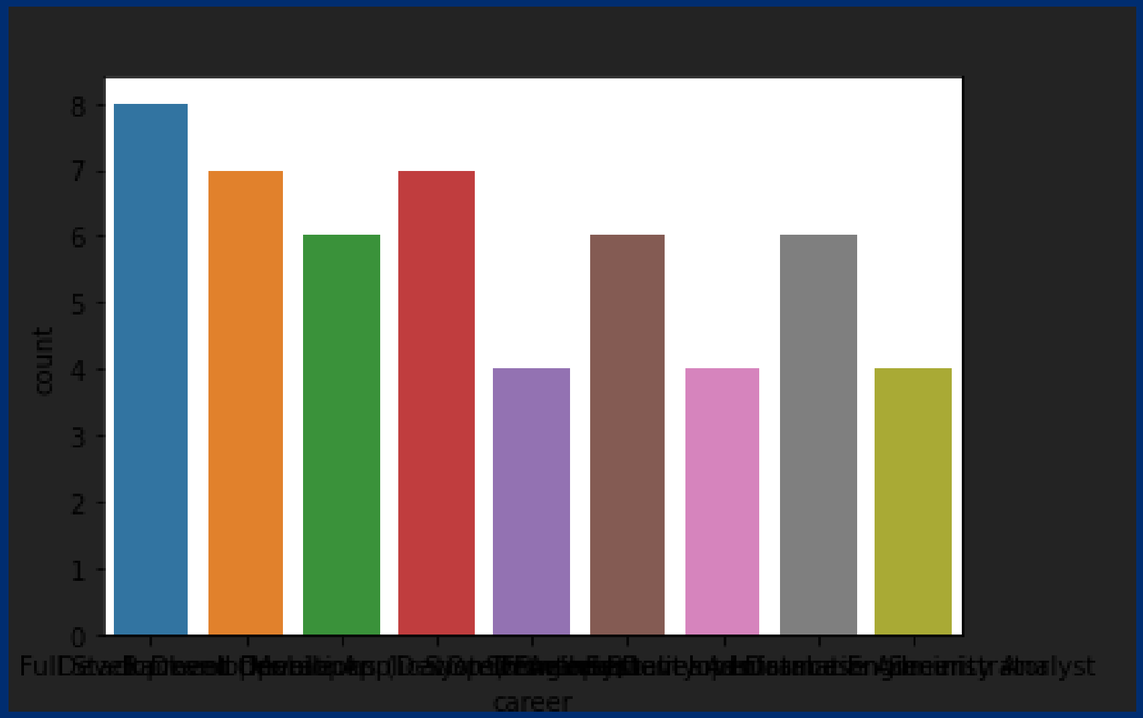
Word cloud of extracted skills from job postings

EVIDENCES FOR THE COMPLETION

```
skill =  ["git, html, php, css, java, flutter, docker, react"]

val = nb.predict(skill)
val2 = sgd.predict(skill)
val3 = logreg.predict(skill)

print("Naive Bayes: ", val[0])
print('accuracy %s' %  round(accuracy_score(y_pred, y_test),2)  + '\n')

print("Linear Support Vector Machine:", val2[0])
print('accuracy %s' %  round(accuracy_score(y_pred, y_test),2)  + '\n')

print("Logistic Regression: ", val3[0])
print('accuracy %s' % round(accuracy_score(y_pred, y_test),2))
```

```
Naive Bayes:  Full Stack Developer
accuracy 0.91

Linear Support Vector Machine: Full Stack Developer
accuracy 0.91

Logistic Regression:  Full Stack Developer
accuracy 0.89
```

Prediction with different models



Training data count plot

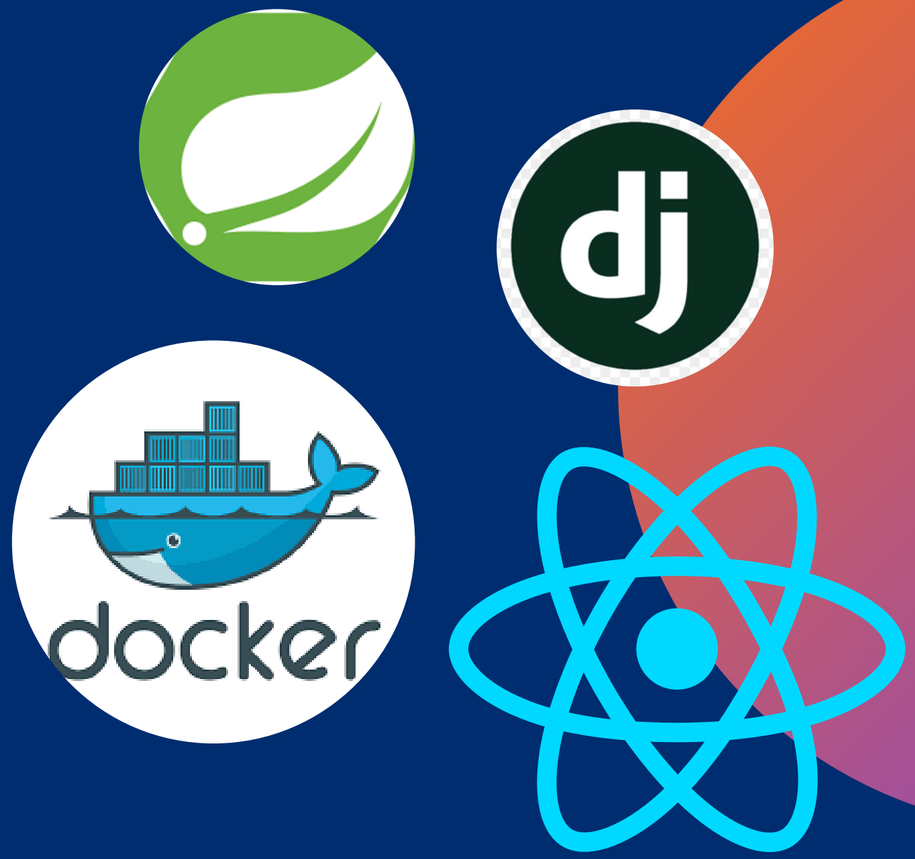
USER/FUNCTIONAL REQUIREMENTS

- **Functional Requirements**
  - Evaluate and identify student technical skills.
  - Recommend most suited job opportunities based on identified skills
  - Identify the most suited career path based on the student skills and the interest.

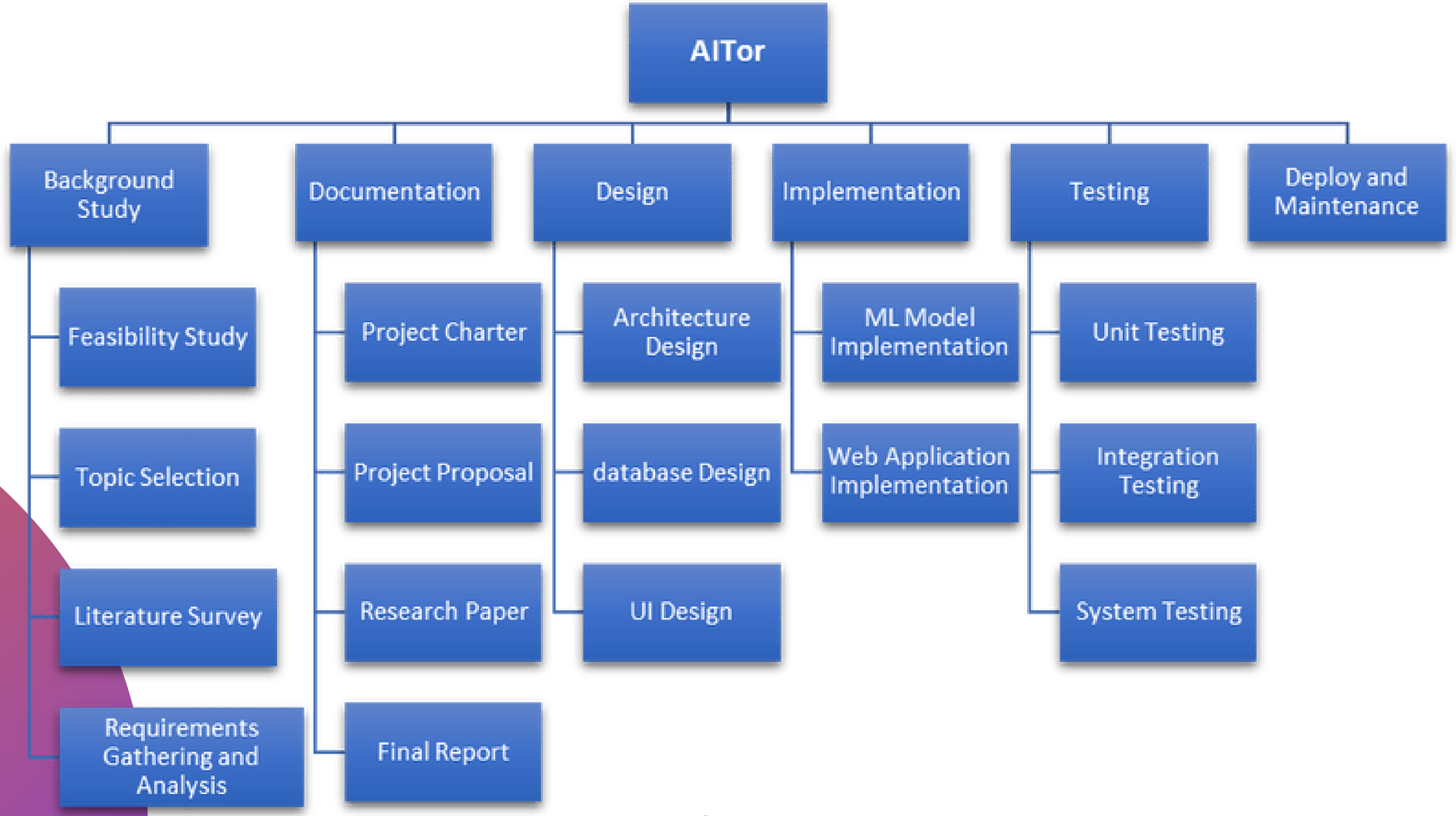
- **Non-functional requirements**
  - Students data privacy need to be secure

Usage of technologies in the relevant key pillar/area

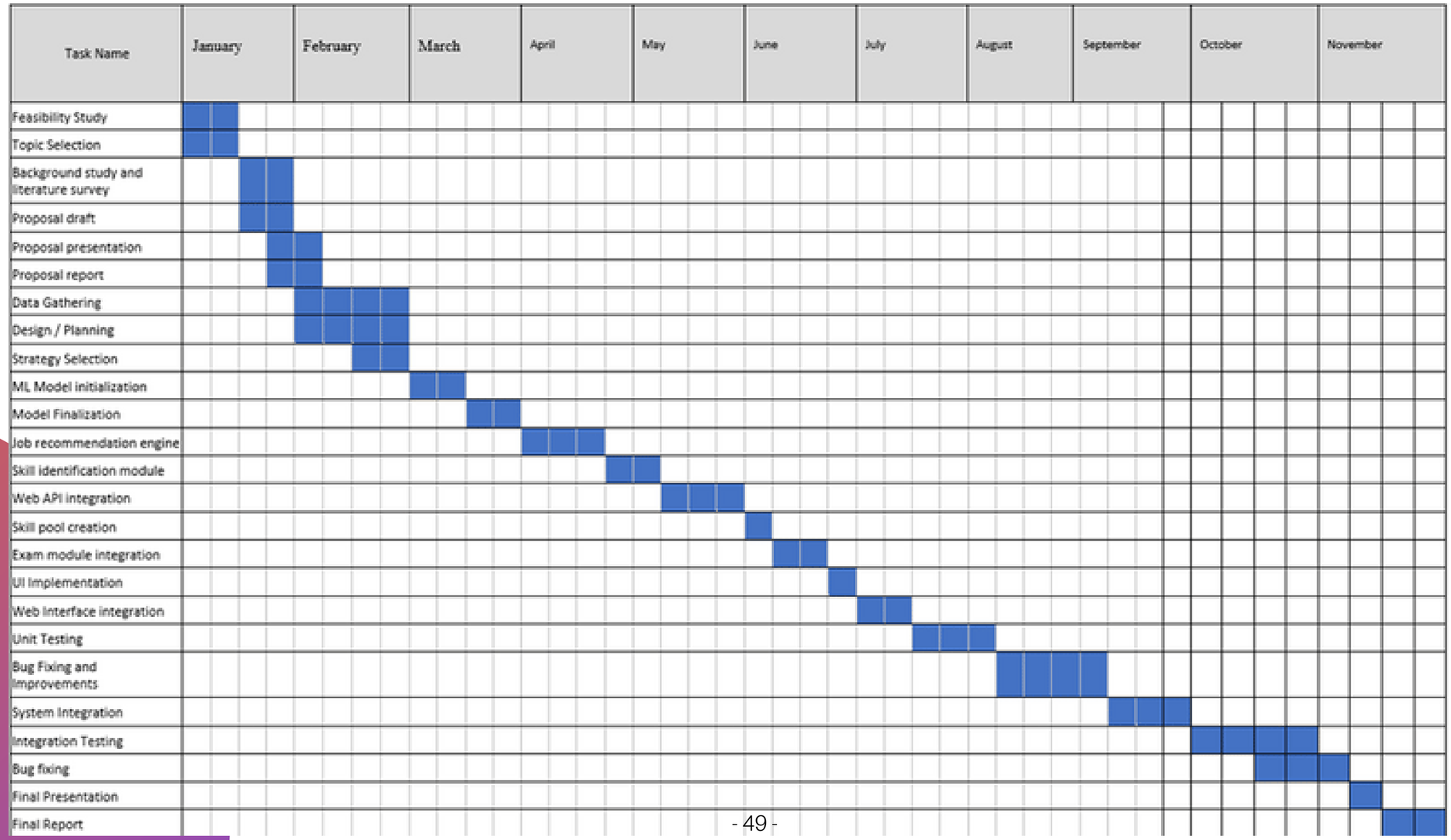
- Python Django will be used in ML model creation
- Scikit learn library will be used to implement ML model
- Initial data preprocessings and Model evaluations is done using Pandas, Numpy and Jupyter notebooks



Work Breakdown Structure



Project Gantt Chart



2022-017

LIYANAGE N.L.T.N.
IT19188546

FOCUSED AREA: Analyze the student performance, forecast and generate a fully detailed report.

SPECIALIZED IN SOFTWARE ENGINEERING

PROBLEM DEFINITION

01 ANALYZE THE PERFORMANCE OF THE STUDENTS

02 CONDUCT A TIME SERIES FORECASTING FOR THE ANALYZED DATA

03 GENERATE A FULLY DETAILED REPORT IN THE SENCE OF INDIVIDUAL AND GROUP

HOW TO ANALYZE, FORECAST AND REPORT THE STUDENT DATA

Identifying stage

Students marks for the assessments

Identified skills of the student

Analyzing stage

Analyze the student performance

Generate the analyzed charts by using POWER BI

Train the data with the selected model

Final Examination Mark

Clustering the skills

Reporting stage

Suggestions and recommendations from the other components

What's in the 50%

01 Ideal Model Selection and Evaluation

02 Time-series forecasting algorithem creation

03 Initial data generate & model training with defined model

04 Design of the student profile user interfaces

50%

APPLICATION OF KEY PILLARS IN THE SPECIALISED AREA

01

Strategies used to analyze the student

Time-Series analyzing / Performance analyzing by taging the students

02

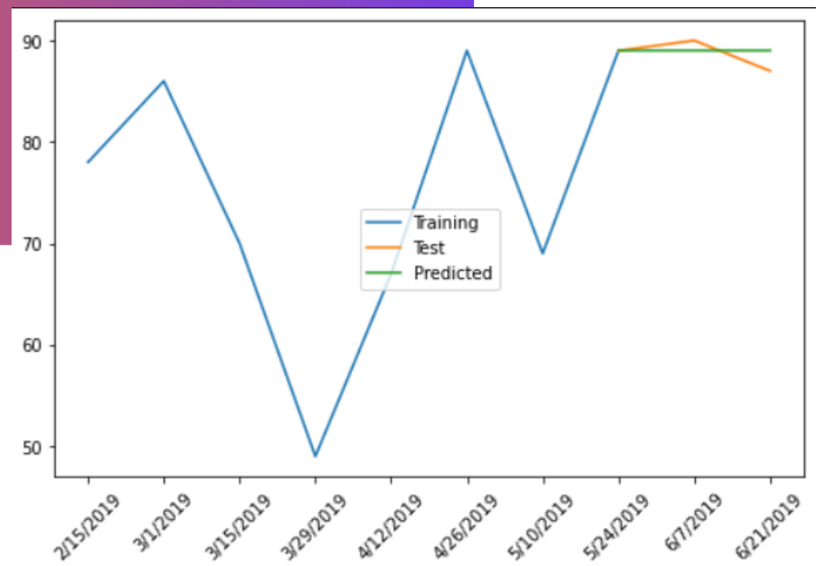
Algorithms available for the forecast

LSTM Model

ARIMA and SARIMA models

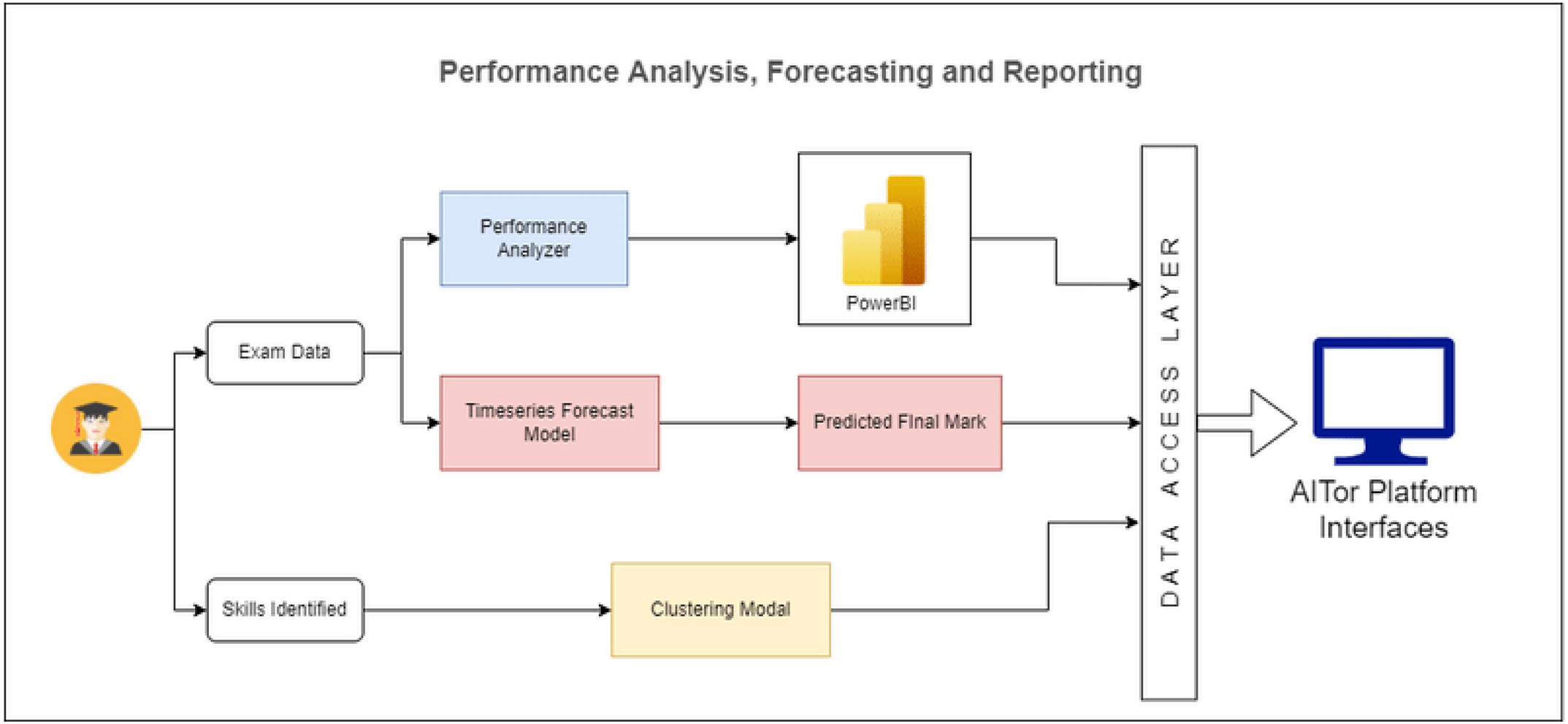
TBATS Model

VARMAX Model



AUTO ARIMA MODEL

USER FLOW IN HIGH LEVEL



EVIDENCES FOR THE COMPLETION

```
[ ] import pandas as pd
    import numpy as np
    import matplotlib as plt
    %matplotlib inline
```

```
[ ] # Load libraries
    import pandas as pd
    # Import Decision Tree Classifier
    from sklearn.tree import DecisionTreeClassifier
    #Import train_test_split function
    from sklearn.model_selection import train_test_split
    #Import scikit-learn metrics module for accuracy calculation
    from sklearn import metrics
```

```
[ ] dataset = pd.read_csv('/content/train_data.csv')
```

```
dataset.head()
```

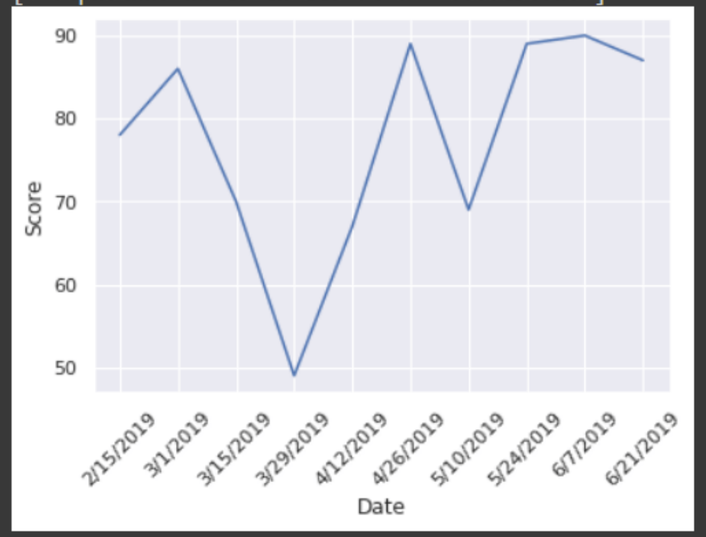
	Date	Score
0	2/15/2019	78
1	3/1/2019	86
2	3/15/2019	70
3	3/29/2019	49
4	4/12/2019	67

```
[ ] import matplotlib.pyplot as plt
    import seaborn as sns
```

```
[ ] sns.set()
```

```
[ ] plt.ylabel('Score')
    plt.xlabel('Date')
    plt.xticks(rotation=45)

    plt.plot(dataset['Date'], dataset['Score'], )
```

```
[<matplotlib.lines.Line2D at 0x7fc80de5cb10>]
```

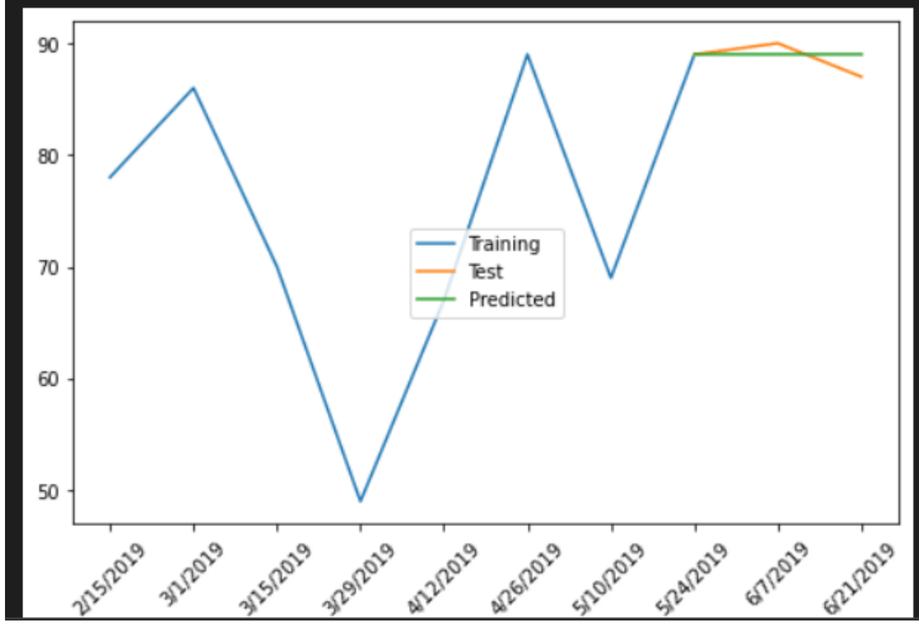


EVIDENCES FOR THE COMPLETION

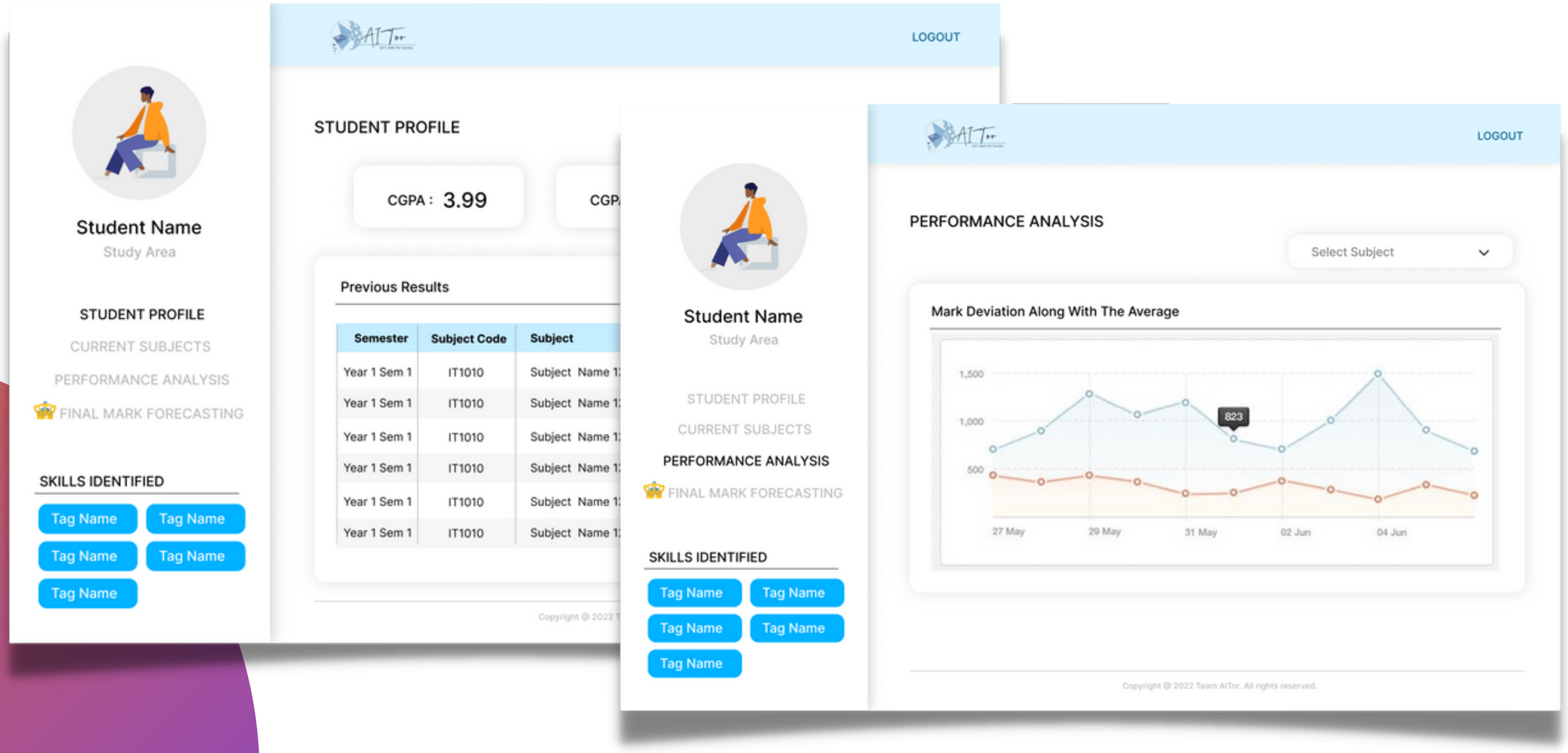
```
train = dataset[dataset['Date'] < "5/10/2019"]
test = dataset[dataset['Date'] > "5/10/2019"]

print(test)


train_date = train['Date'].to_numpy()
train_score = train['Score'].to_numpy()


test_date = test['Date'].to_numpy()
test_score = test['Score'].to_numpy()

print(test_date.shape)


plt.plot(train_date,train_score, color = "blue")
plt.plot(test_date,test_score, color = "red")
plt.ylabel('Score')
plt.xlabel('Date')
plt.xticks(rotation=45)
plt.title("Train/Test split for Student Marks Data")
plt.show()
```

```
plt.figure(figsize=(8,5))
plt.plot(train,label="Training")
plt.plot(test, label="Test")
plt.plot (prediction, label="Predicted" )
plt.legend( loc = 'center')

plt.xticks(rotation=45)
plt. show()
```

✓ 0.3s



EVIDENCES FOR THE COMPLETION



USER/FUNCTIONAL REQUIREMENTS

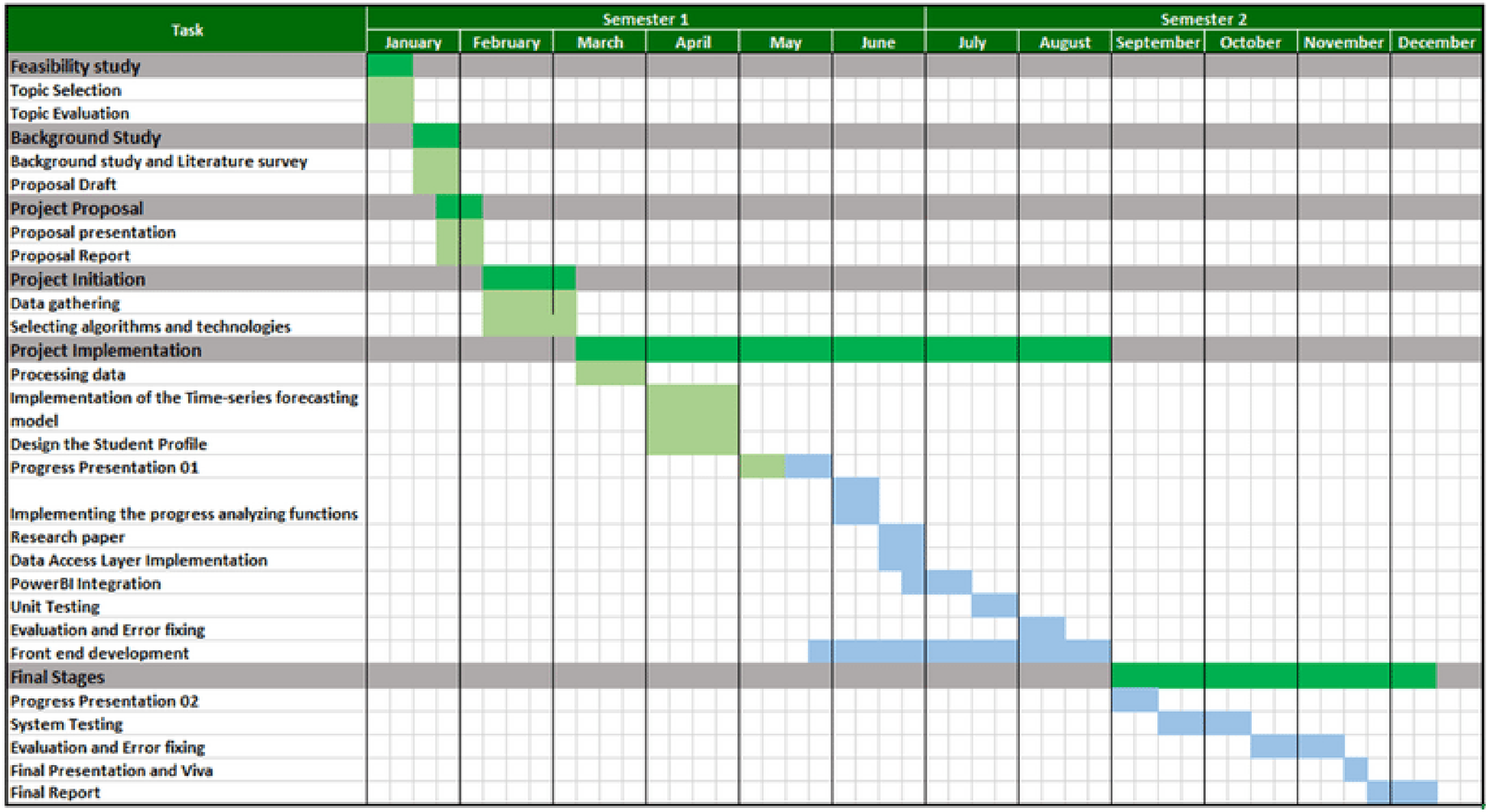
- **Functional Requirements**
  - Conduct a performance analysis based on the student exam mark.
  - Forecast the final examination marks based on the other examinations.
  - Generate a fully detailed report which helpes both the tutor and the student.

- **Non-functional requirements**
  - Ensureing the security of the student's data when the reporting the outcome.

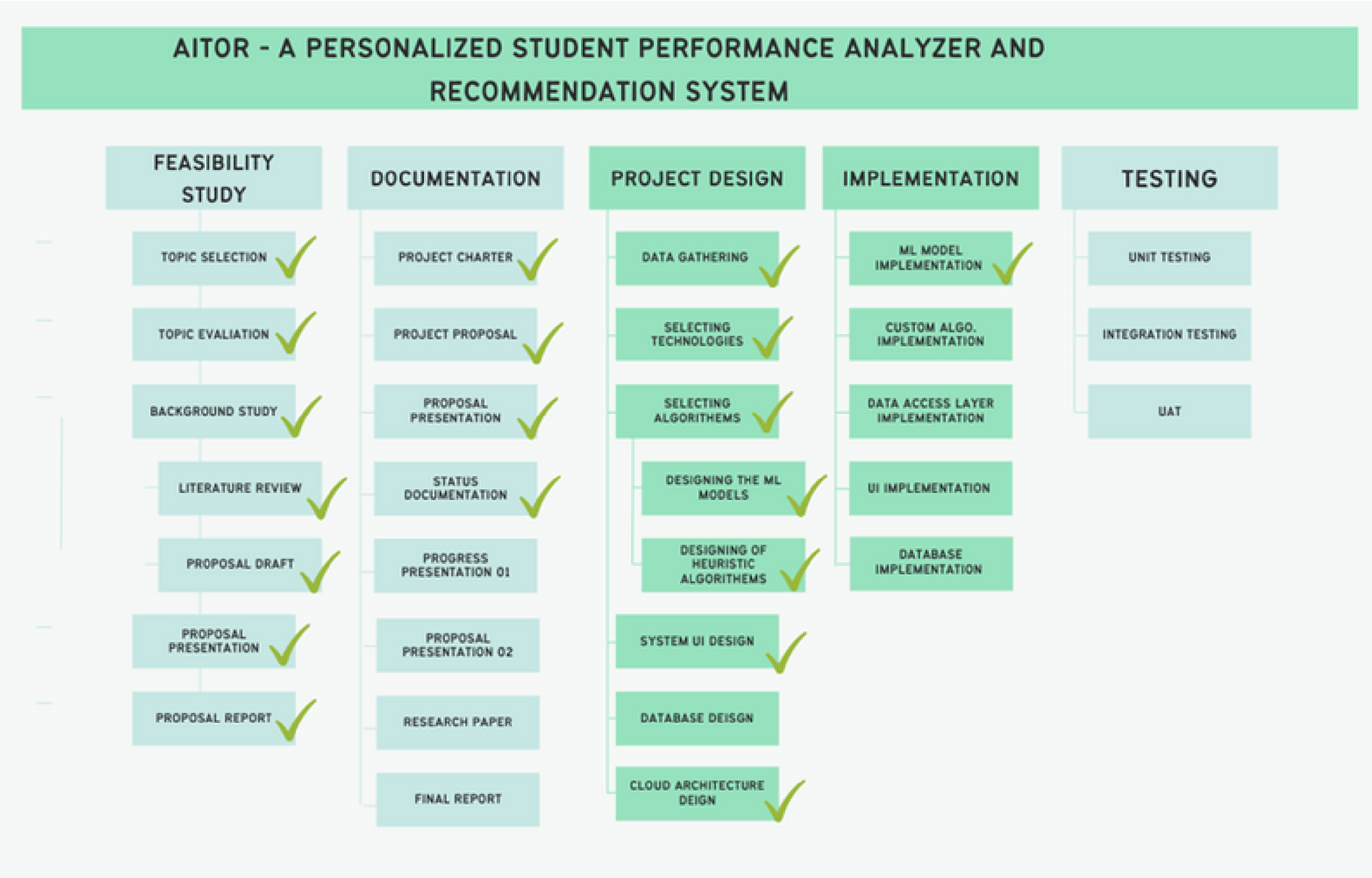
Usage of technologies in the relevant key pillar/area

COMPONENT/MODULE	TECHNIQUES	RULES AND ALGORITHEMS	TECHNOLOGIES
TS Forecasting model	Timeseries Forecasting	ARIMA	Python, Scikit-learn, Pandas, Numpy, Django
User Interface for Student Profile	Ui/UX		Figma

PROJECT GANTT CHARTT



WORK BREAKDOWN CHART



Commercialization

What we offer?

1 Month Free Trial

With all functionalities of the system

Paid Version

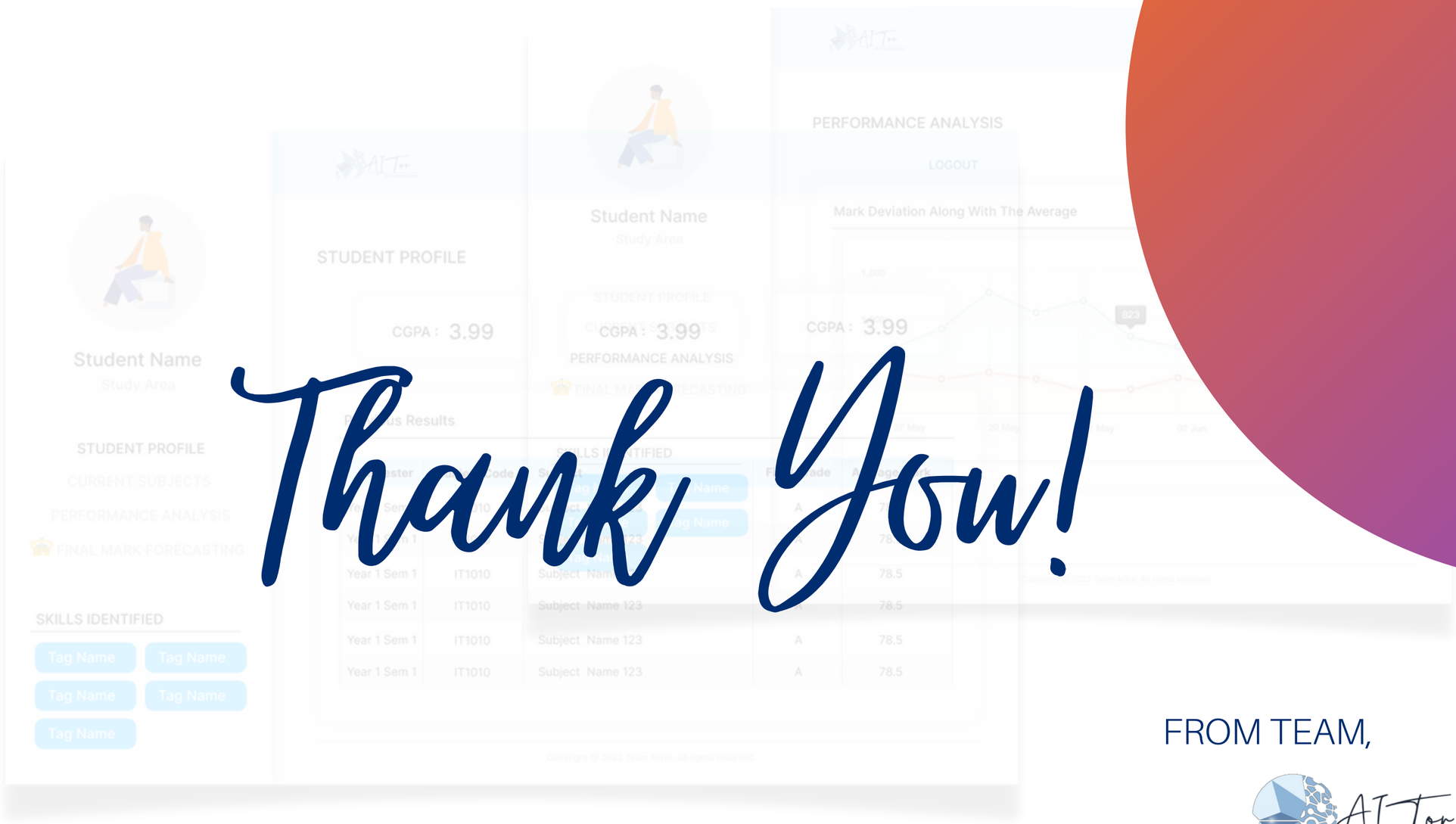
- With all functionalities of the system
- 24/7 Service

Free Version

With limited functionalities of the system

VALUE PREPOSITION

Package	Featuers Included	Price
Pro starter	• Student performance analyser • Target for educational institutes having student count of below 1000	USD 1500 per month 1.5 USD per Student
Prod Ultimate	• Student performance analyser • Carrier recommendation • Final grade forecasting and Tutor guide • Target for educational institutes having student count of over1000 ~ 3000	USD 3000 per month ~ 1.5 USD per Student



Thank You!

FROM TEAM,

AITor
Let's Seek the Success

| 2022-017