CHAPTER 1

INTRODUCTION

Artificial Intelligence (AI) and Machine Learning (ML) have become integral components of modern digital systems. With the exponential growth of data generated by online platforms, organizations are increasingly dependent on intelligent systems to analyze user behavior and make strategic decisions.

In today's competitive digital environment, customer retention has become more important than customer acquisition. Understanding why users disengage from products and predicting such behavior in advance is crucial.

This project focuses on predicting user churn using AI techniques and deploying the solution using Docker and Kubernetes.

CHAPTER 2

LITERATURE REVIEW

Customer churn prediction has been widely studied in data mining and machine learning research.

Traditional statistical methods were limited in handling complex patterns.

Modern machine learning techniques have improved accuracy but often ignore deployment challenges.

CHAPTER 3

PROBLEM STATEMENT

Customer churn negatively impacts revenue and growth.

Manual and delayed analysis methods are ineffective.

An automated, scalable AI system is required.

CHAPTER 4:

OBJECTIVES

Design an AI-based churn prediction system.

Provide a user-friendly dashboard.

Deploy the system using Docker and Kubernetes.

CHAPTER 5

SYSTEM ARCHITECTURE

The system follows a microservices architecture.

Streamlit acts as the frontend, FastAPI as the backend.

Kubernetes manages deployment and scaling.

CHAPTER 6

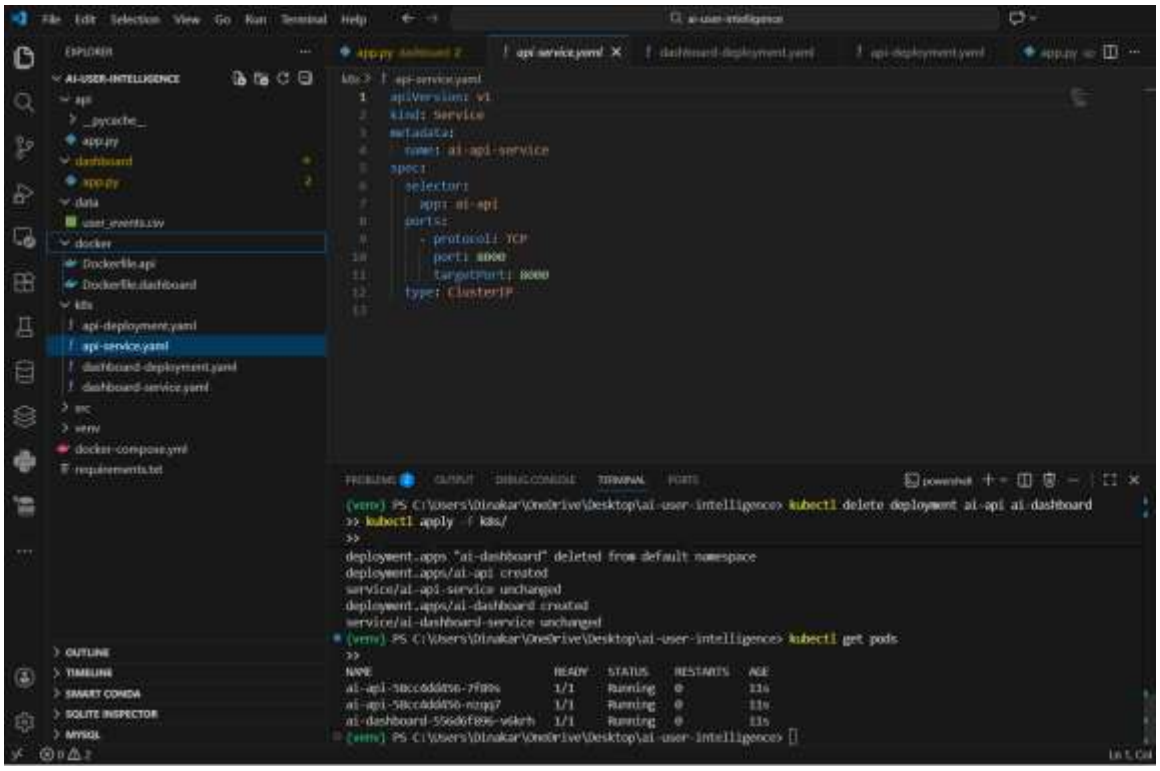
CONCLUSION

This project demonstrates end-to-end AI system development.

It aligns academic learning with industry practices.

The project prepares the developer for real-world AI roles.

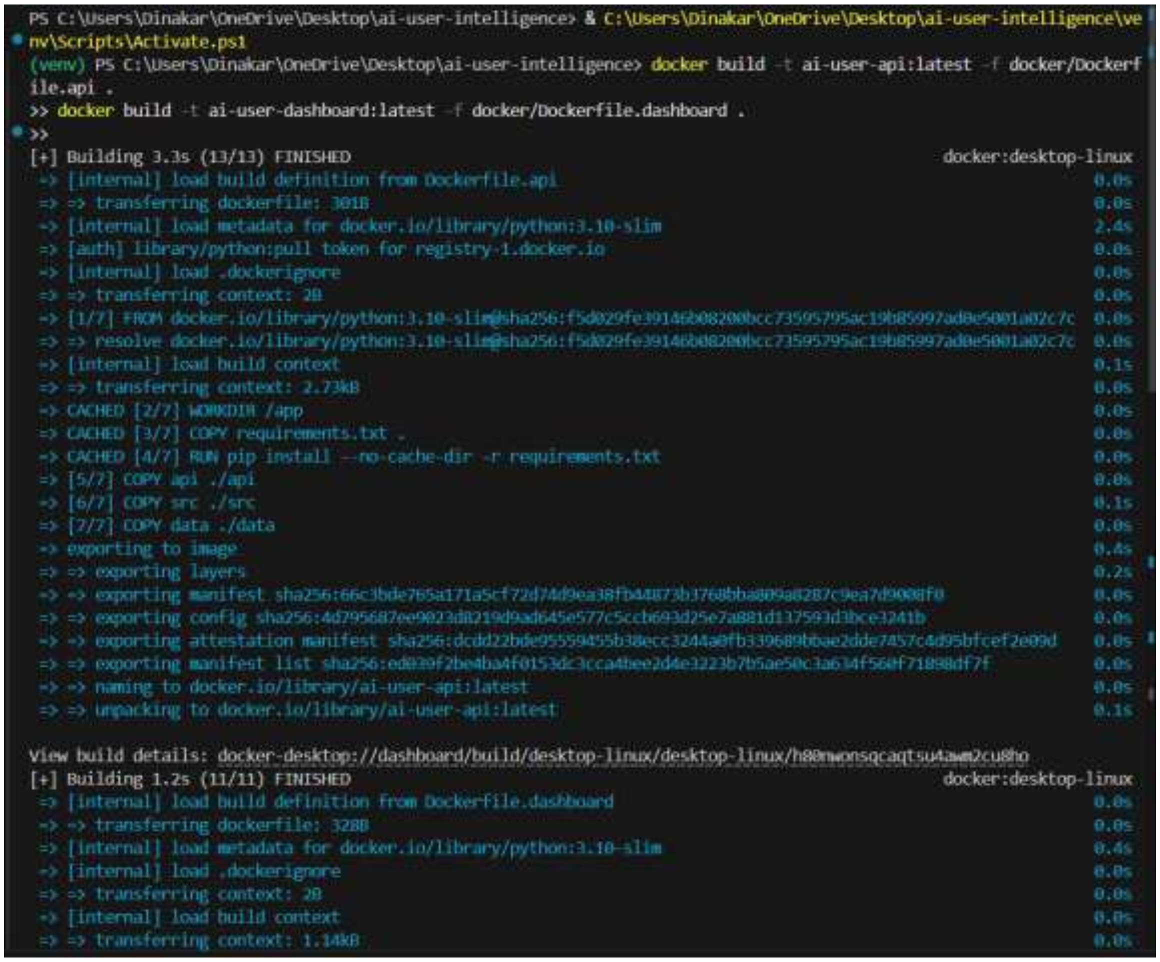
Screenshots



```yaml
apiVersion: v1
kind: Service
metadata:
  name: ai-api-service
spec:
  selector:
    app: ai-api
  ports:
    - protocol: TCP
      port: 8000
      targetPort: 8000
  type: ClusterIP
```

```
(venv) PS C:\Users\Dinakar\OneDrive\Desktop\ai-user-intelligence> kubectl delete deployment ai-api ai-dashboard
>> kubectl apply -f k8s/
>>
deployment.apps "ai-dashboard" deleted from default namespace
deployment.apps/ai-api created
service/ai-api-service unchanged
deployment.apps/ai-dashboard created
service/ai-dashboard-service unchanged
(venv) PS C:\Users\Dinakar\OneDrive\Desktop\ai-user-intelligence> kubectl get pods
>>
NAME                            READY   STATUS    RESTARTS   AGE
ai-api-58ccddd856-7f89s         1/1     Running   0          11s
ai-api-58ccddd856-nzqg7         1/1     Running   0          11s
ai-dashboard-556d6f896-v6krh    1/1     Running   0          11s
(venv) PS C:\Users\Dinakar\OneDrive\Desktop\ai-user-intelligence>
```

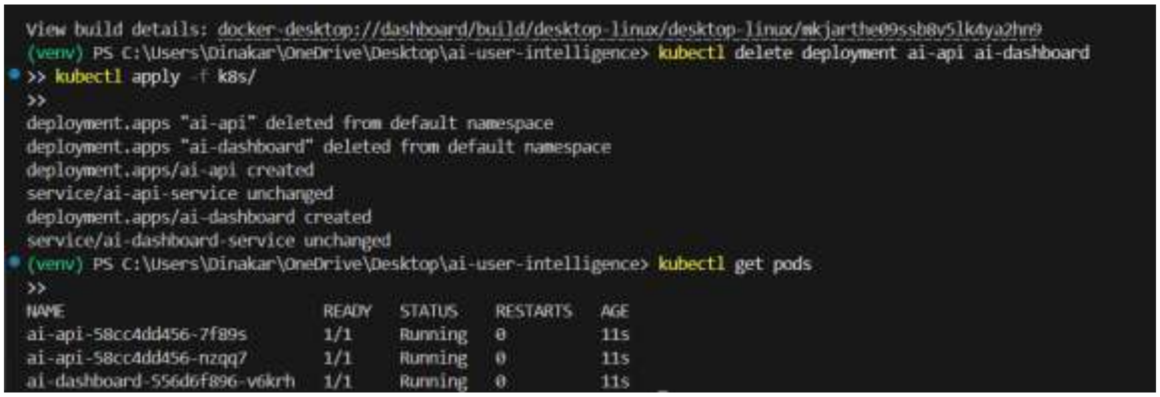
Visual Studio



```
PS C:\Users\Dinakar\OneDrive\Desktop\ai-user-intelligence> & C:\Users\Dinakar\OneDrive\Desktop\ai-user-intelligence\ve
nv\Scripts\Activate.ps1
(venv) PS C:\Users\Dinakar\OneDrive\Desktop\ai-user-intelligence> docker build -t ai-user-api:latest -f docker/Dockerf
ile.api .
>> docker build -t ai-user-dashboard:latest -f docker/Dockerfile.dashboard .
>>
[+] Building 3.3s (13/13) FINISHED                                                               docker:desktop-linux
 => [internal] load build definition from Dockerfile.api                                                          0.0s
 => => transferring dockerfile: 301B                                                                              0.0s
 => [internal] load metadata for docker.io/library/python:3.10-slim                                               2.4s
 => [auth] library/python:pull token for registry-1.docker.io                                                     0.0s
 => [internal] load .dockerignore                                                                                 0.0s
 => => transferring context: 2B                                                                                   0.0s
 => [1/7] FROM docker.io/library/python:3.10-slim@sha256:f5d029fe39146b08200bcc73595795ac19b85997ad0e5001a02c7c  0.0s
 => => resolve docker.io/library/python:3.10-slim@sha256:f5d029fe39146b08200bcc73595795ac19b85997ad0e5001a02c7c  0.0s
 => [internal] load build context                                                                                 0.1s
 => => transferring context: 2.73kB                                                                               0.0s
 => CACHED [2/7] WORKDIR /app                                                                                     0.0s
 => CACHED [3/7] COPY requirements.txt .                                                                          0.0s
 => CACHED [4/7] RUN pip install --no-cache-dir -r requirements.txt                                               0.0s
 => [5/7] COPY api ./api                                                                                          0.0s
 => [6/7] COPY src ./src                                                                                          0.1s
 => [7/7] COPY data ./data                                                                                        0.0s
 => exporting to image                                                                                            0.4s
 => => exporting layers                                                                                           0.2s
 => => exporting manifest sha256:66c3bde765a171a5cf72d74d9ea38fb44873b3768bba809a8287c9ea7d9008f0                 0.0s
 => => exporting config sha256:4d795687ee9023d8219d9ad645e577c5ccb693d25e7a881d137593d3bce3241b                   0.0s
 => => exporting attestation manifest sha256:dcdd22bde95559455b38ecc3244a0fb339689bbae2dde7457c4d95bfcef2e09d     0.0s
 => => exporting manifest list sha256:ed039f2be4ba4f0153dc3cca4bee2d4e3223b7b5ae50c3a634f560f71898df7f            0.0s
 => => naming to docker.io/library/ai-user-api:latest                                                             0.0s
 => => unpacking to docker.io/library/ai-user-api:latest                                                          0.1s

View build details: docker-desktop://dashboard/build/desktop-linux/desktop-linux/h80mwonsqcaqtsu4awm2cu8ho
[+] Building 1.2s (11/11) FINISHED                                                               docker:desktop-linux
 => [internal] load build definition from Dockerfile.dashboard                                                    0.0s
 => => transferring dockerfile: 328B                                                                              0.0s
 => [internal] load metadata for docker.io/library/python:3.10-slim                                               0.4s
 => [internal] load .dockerignore                                                                                 0.0s
 => => transferring context: 2B                                                                                   0.0s
 => [internal] load build context                                                                                 0.0s
 => => transferring context: 1.14kB                                                                               0.0s
```

Docker Build



```
View build details: docker-desktop://dashboard/build/desktop-linux/desktop-linux/mkjarthe09ssb8v5lk4ya2hn9
(venv) PS C:\Users\Dinakar\OneDrive\Desktop\ai-user-intelligence> kubectl delete deployment ai-api ai-dashboard
>> kubectl apply -f k8s/
>>
deployment.apps "ai-api" deleted from default namespace
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deployment.apps/ai-api created
service/ai-api-service unchanged
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service/ai-dashboard-service unchanged
(venv) PS C:\Users\Dinakar\OneDrive\Desktop\ai-user-intelligence> kubectl get pods
>>
NAME                           READY   STATUS    RESTARTS   AGE
ai-api-58cc4dd456-7f89s        1/1     Running   0          11s
ai-api-58cc4dd456-nzqq7        1/1     Running   0          11s
ai-dashboard-556d6f896-v6krh   1/1     Running   0          11s
```
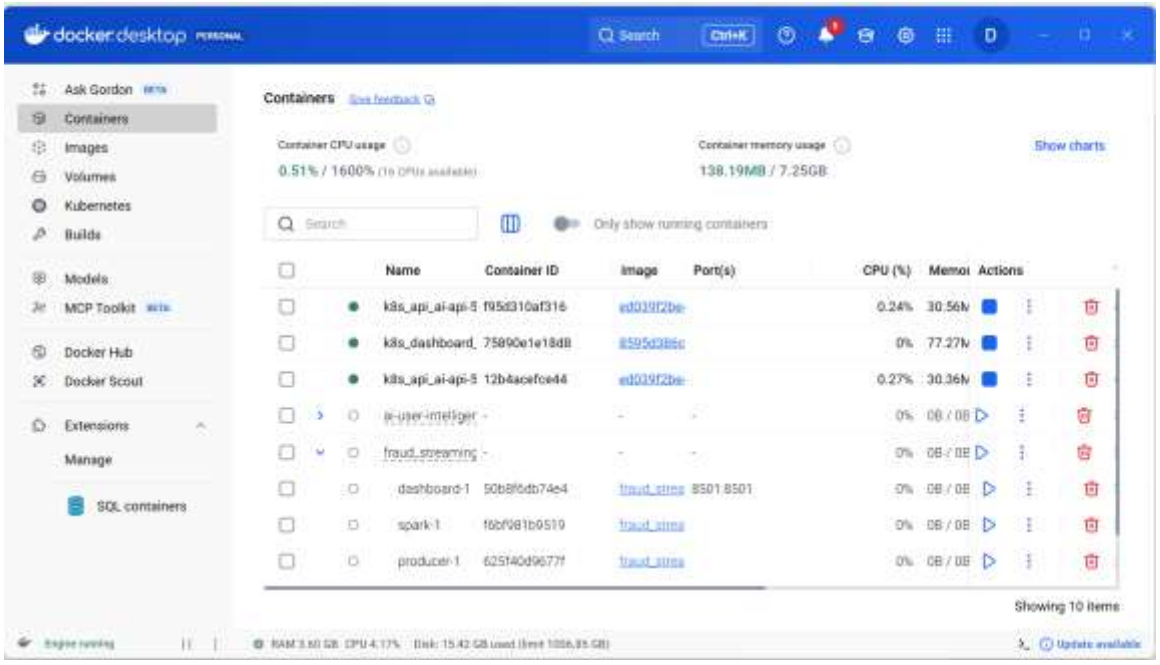

Kubernetes Deployment



Containers

Container CPU usage
0.51% / 1600% (16 CPUs available)

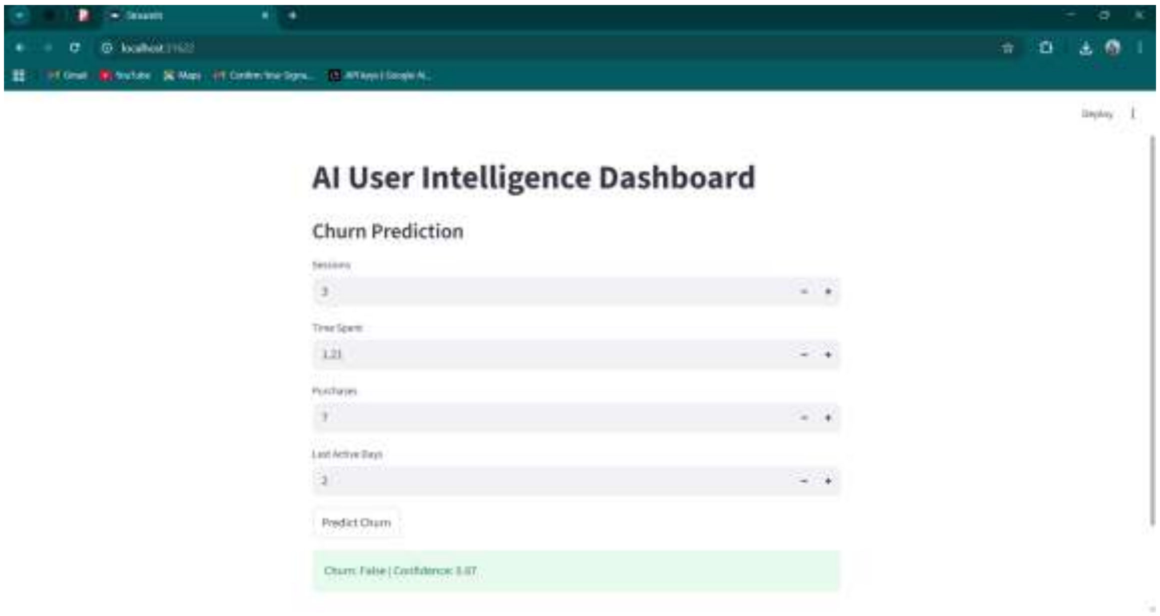
Container memory usage
138.19MB / 7.25GB

	Name	Container ID	Image	Port(s)	CPU (%)	Memoi
●	k8s_api_ai-api-5	f95d310af316	ed039f2be		0.24%	30.56M
●	k8s_dashboard_	75890e1e18d8	8595d386c		0%	77.27M
●	k8s_api_ai-api-5	12b4acefce44	ed039f2be		0.27%	30.36M
○	ai-user-intelliger	-	-	-	0%	0B / 0B
○	fraud_streaming	-	-	-	0%	0B / 0B
○	dashboard-1	50b8f6db74e4	fraud_strea	8501:8501	0%	0B / 0B
○	spark-1	f6bf981b9519	fraud_strea		0%	0B / 0B
○	producer-1	625f40d9677f	fraud_strea		0%	0B / 0B

Showing 10 items

RAM 3.60 GB CPU 4.17% Disk: 15.42 GB used (limit 1006.85 GB)

Docker Desktop



AI User Intelligence Dashboard

Churn Prediction

Sessions: 3

Time Spent: 1.21

Purchases: 7

Last Active Days: 2

Churn: False | Confidence: 1.07

Streamlit Dashboard