Web Based Dashboards

Module # 6 (Web Application Database Connection)

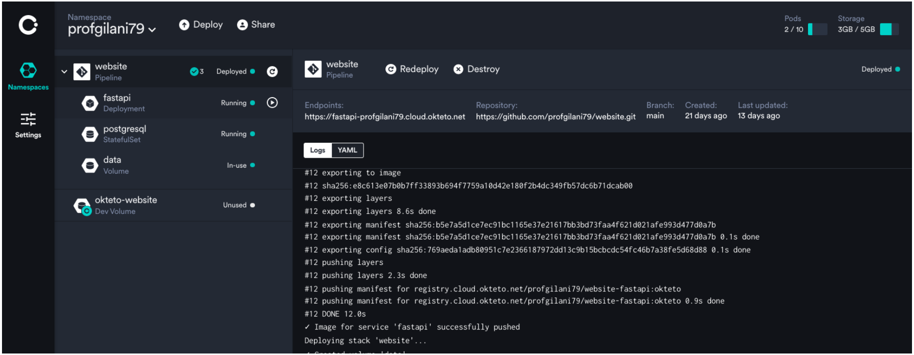
Dr. Wajahat Gilani

Rutgers Business School

July 15, 2021

Uploading Data to DataBase

Now that we have our database set up in Okteto and we have loaded up data into the database, we can now connect our sample web application to our postgresql database.



website Pipeline 3 Deployed

fastapi Deployment Running

postgresql StatefulSet Running

data Volume In-use

okteto-website Dev Volume Unused

website Pipeline Deployed

Endpoints: https://fastapi-profgilani79.cloud.okteto.net

Repository: https://github.com/profgilani79/website.git

Branch: main

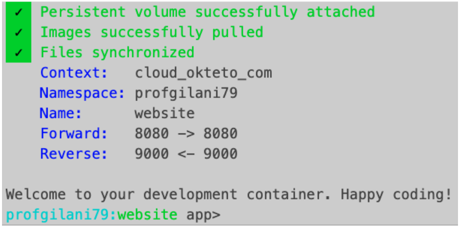
Created: 21 days ago

Last updated: 13 days ago

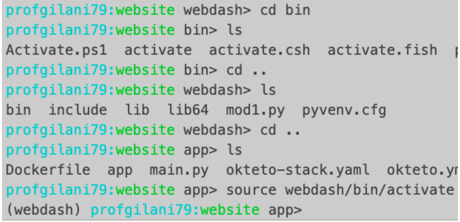
```
#12 exporting to image
#12 sha256:e8c613e07b0b7ff33893b694f7759a10d42e180f2b4dc349fb57dc6b71dcab00
#12 exporting layers
#12 exporting layers 8.6s done
#12 exporting manifest sha256:b5e7a5d1ce7ec91bc1165e37e21617bb3bd73faa4f621d021afe993d477d0a7b
#12 exporting manifest sha256:b5e7a5d1ce7ec91bc1165e37e21617bb3bd73faa4f621d021afe993d477d0a7b 0.1s done
#12 exporting config sha256:769aeda1adb80951c7e2366187972dd13c9b15bcbcdc54fc46b7a38fe5d68d88 0.1s done
#12 pushing layers
#12 pushing layers 2.3s done
#12 pushing manifest for registry.cloud.okteto.net/profgilani79/website-fastapi:okteto
#12 pushing manifest for registry.cloud.okteto.net/profgilani79/website-fastapi:okteto 0.9s done
#12 DONE 12.0s
✓ Image for service 'fastapi' successfully pushed
Deploying stack 'website'...
✓ Created volume 'data'
```

Connect to Okteto

Open up the console in atom and log into Okteto and type in the following commands:



```
 ✓  Persistent volume successfully attached
 ✓  Images successfully pulled
 ✓  Files synchronized
    Context:   cloud_okteto_com
    Namespace: profgilani79
    Name:      website
    Forward:   8080 -> 8080
    Reverse:   9000 <- 9000

Welcome to your development container. Happy coding!
profgilani79:website app>
```



```
profgilani79:website webdash> cd bin
profgilani79:website bin> ls
Activate.ps1  activate  activate.csh  activate.fish  p
profgilani79:website bin> cd ..
profgilani79:website webdash> ls
bin  include  lib  lib64  mod1.py  pyvenv.cfg
profgilani79:website webdash> cd ..
profgilani79:website app> ls
Dockerfile  app  main.py  okteto-stack.yaml  okteto.yr
profgilani79:website app> source webdash/bin/activate
(webdash) profgilani79:website app>
```

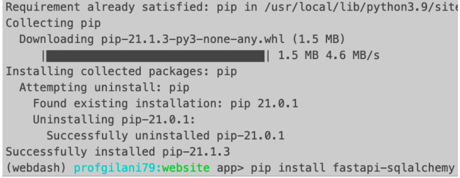
- okteto login
- okteto namespace
- okteto up

Enter the virtual environment:

- (mac command) source webdash/bin/activate

Install SQLAlchemy for FastAPI

Now that we are in our Okteto's virtual environment, we need to install SQLAlchemy. SQLAlchemy is a well-regarded database toolkit and object-relational mapper (ORM) implementation written in Python. SQLAlchemy provides a generalized interface for creating and executing database-agnostic code without needing to write SQL statements. We will need to install 4 new libraries:



```
Requirement already satisfied: pip in /usr/local/lib/python3.9/site
Collecting pip
  Downloading pip-21.1.3-py3-none-any.whl (1.5 MB)
     |████████████████████████████████| 1.5 MB 4.6 MB/s
Installing collected packages: pip
  Attempting uninstall: pip
    Found existing installation: pip 21.0.1
    Uninstalling pip-21.0.1:
      Successfully uninstalled pip-21.0.1
Successfully installed pip-21.1.3
(webdash) profgilani79:website app> pip install fastapi-sqlalchemy
```

- pip install fastapi-sqlalchemy
- pip install async-exit-stack
- pip install async-generator
- pip install psycopg2-binary

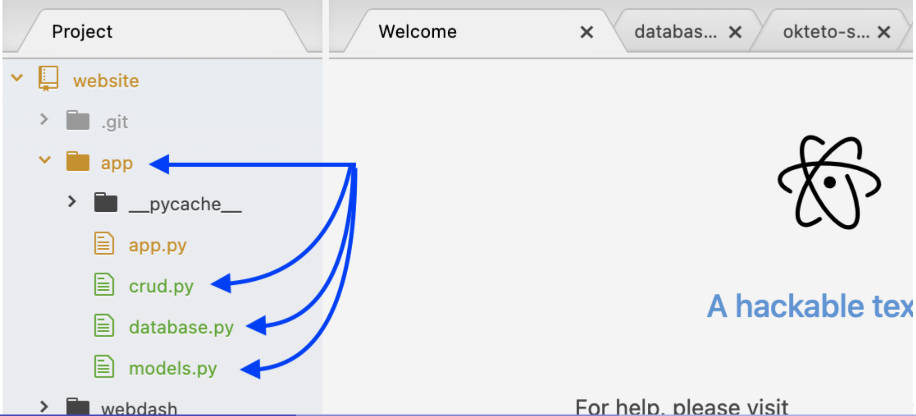
Also install the files from your requirements.txt file, because this a development environment that goes to sleep, we need to re-install those libraries everytime we re-connect with our testing environment after some period of time.

```
pip install -r requirements.txt
```

Create 3 New Python Files in the app Folder

In the app folder, create a 3 new python files named:

- database.py - in this file we will write the commands to connect to our database
- models.py - in this file we write classes that represent our database tables (salary)
- crud.py - in this file we write functions that query our database tables



File database.py

Add the following import commands

```
from sqlalchemy import create_engine
from sqlalchemy.ext.declarative import declarative_base
from sqlalchemy.orm import sessionmaker
```

Now add the URL for the PostGRESQL database, same as the one in our okteto-stack.yaml file.

```
SQLALCHEMY_DATABASE_URL = "postgresql://pguser:pgpass@postgresql:5432/pgdb"
```

Now create 3 new variables:

```
engine = create_engine(SQLALCHEMY_DATABASE_URL)
SessionLocal = sessionmaker(autocommit=False, autoflush=False, bind=engine)
Base = declarative_base()
```

These variables are connecting to our database and creating connections for our web application to use

File models.py

```
from sqlalchemy import Column, Float, String, Integer, Numeric
from .database import Base

class salary(Base):
  __tablename__ = "salary"
  id = Column(Integer, primary_key=True, index=True)
  player = Column(String, unique=True, index=True)
  fieldposition = Column(String)
  team = Column(String)
  salary= Column(Numeric)
```

In models.py we create our class object, that is basically a python representation of our database table salary. Here we have a slight error that we will have to fix a little later. SQLAlchemy doesn't have a money data-type for columns, we should have instead used numeric (oops).

Notice how in the second line, we are importing the Base variable that we create in the database.py file.

File crud.py

```
from sqlalchemy.orm import Session
from . import models

def get_salary(db: Session):
  return db.query(models.salary.player, models.salary.fieldposition, models.salary.team).
       all()
```

In crud.py, line # 2, we import all the class objects from models.py (salary). We also define a function, salary, that will take a connection from the database as a parameter, and use it to query a specific table, in this case salary. Notice how the query command is independent of the table, implying that we can query for columns from multiple tables. This is done by defining relationships between those class objects (will discuss later).

Also notice that we aren't calling the salary column, this is because of the fact we used the money data-type instead of numeric (we will fix it later).

File crud.py

```
from sqlalchemy.orm import Session
from . import models

def get_salary(db: Session):
return db.query(models.salary.player, models.salary.fieldposition, models.salary.team).
     all()
```

In crud.py, line # 2, we import all the class objects from models.py (salary). We also define a function, salary, that will take a connection from the database as a parameter, and use it to query a specific table, in this case salary. Notice how the query command is independent of the table, implying that we can query for columns from multiple tables. This is done by defining relationships between those class objects (will discuss later).

Also notice that we aren't calling the salary column, this is because of the fact we used the money data-type instead of numeric (we will fix it later).

Update app.py

```
from fastapi import FastAPI, Depends
from sqlalchemy.orm import Session

from . import crud, models
from .database import SessionLocal, engine

models.Base.metadata.create_all(bind=engine)
app = FastAPI()

def get_db():
  db = SessionLocal()
  try:
    yield db
  finally:
    db.close()

@app.get("/")
def welcome(db: Session=Depends(get_db)):
  x = crud.get_salary(db)
  8return x
```

The app.py file has to be updated. In line 4, we are importing our models and functions from our files. In line 7, that command creates any tables that have NOT been created yet, and links to any tables that have already been created. In lines 10-17, we are defining a db object that can efficiently used asynchronously, allowing for greater efficiency for websites that are being viewed a lot.

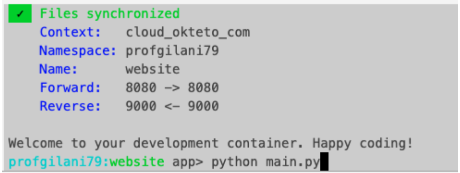
Update app.py

```
from fastapi import FastAPI, Depends
from sqlalchemy.orm import Session

from . import crud, models
from .database import SessionLocal, engine

models.Base.metadata.create_all(bind=engine)
app = FastAPI()

def get_db():
  db = SessionLocal()
  try:
    yield db
  finally:
    db.close()

@app.get("/")
def welcome(db: Session=Depends(get_db)):
  x = crud.get_salary(db)
  return x
```

Finally in our welcome function, we now add a parameter that gets passed the db object. That db object we pass to our get_salary command, which then will call our SQLAlchemy query, and store the results into x, which we then return (to the browser). Lets do it.

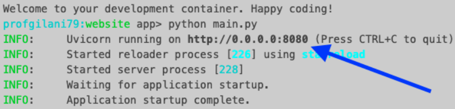
Update app.py

Start your test web server python main.py

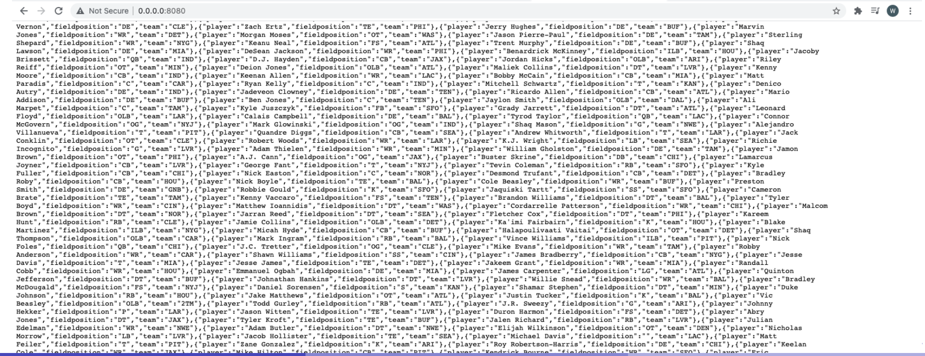


```
✓ Files synchronized
   Context:    cloud_okteto_com
   Namespace:  profgilani79
   Name:       website
   Forward:    8080 -> 8080
   Reverse:    9000 <- 9000

Welcome to your development container. Happy coding!
profgilani79:website app> python main.py
```

Type in your URL into your browser:



```
Welcome to your development container. Happy coding!
profgilani79:website app> python main.py
INFO:     Uvicorn running on http://0.0.0.0:8080 (Press CTRL+C to quit)
INFO:     Started reloader process [226] using statreload
INFO:     Started server process [228]
INFO:     Waiting for application startup.
INFO:     Application startup complete.
```

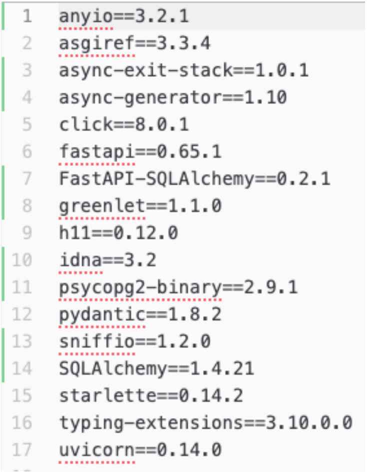


```
Vernon","fieldposition":"DE","team":"CLE"},{"player":"Zach Ertz","fieldposition":"TE","team":"PHI"},{"player":"Jerry Hughes","fieldposition":"DE","team":"BUF"},{"player":"Marvin
Jones","fieldposition":"WR","team":"DET"},{"player":"Morgan Moses","fieldposition":"OT","team":"WAS"},{"player":"Jason Pierre-Paul","fieldposition":"DE","team":"TAM"},{"player":"Sterling
Shepard","fieldposition":"WR","team":"NYG"},{"player":"Keanu Neal","fieldposition":"FS","team":"ATL"},{"player":"Trent Murphy","fieldposition":"DE","team":"BUF"},{"player":"Shaq
Lawson","fieldposition":"DE","team":"MIA"},{"player":"DeSean Jackson","fieldposition":"WR","team":"PHI"},{"player":"Benardrick McKinney","fieldposition":"ILB","team":"HOU"},{"player":"Jacoby
Brissett","fieldposition":"QB","team":"IND"},{"player":"D.J. Hayden","fieldposition":"CB","team":"JAX"},{"player":"Jordan Hicks","fieldposition":"OLB","team":"ARI"},{"player":"Riley
Reiff","fieldposition":"OT","team":"MIN"},{"player":"Deion Jones","fieldposition":"OLB","team":"ATL"},{"player":"Maliek Collins","fieldposition":"DT","team":"LVR"},{"player":"Kenny
Moore","fieldposition":"CB","team":"IND"},{"player":"Keenan Allen","fieldposition":"WR","team":"LAC"},{"player":"Bobby McCain","fieldposition":"CB","team":"MIA"},{"player":"Matt
Paradis","fieldposition":"C","team":"CAR"},{"player":"Ryan Kelly","fieldposition":"C","team":"IND"},{"player":"Mitchell Schwartz","fieldposition":"T","team":"KAN"},{"player":"Denico
Autry","fieldposition":"DE","team":"IND"},{"player":"Jadeveon Clowney","fieldposition":"DE","team":"TEN"},{"player":"Ricardo Allen","fieldposition":"CB","team":"ATL"},{"player":"Mario
Addison","fieldposition":"DE","team":"BUF"},{"player":"Ben Jones","fieldposition":"C","team":"TEN"},{"player":"Jaylon Smith","fieldposition":"OLB","team":"DAL"},{"player":"Ali
Marpet","fieldposition":"C","team":"TAM"},{"player":"Kyle Juszczyk","fieldposition":"FB","team":"SFO"},{"player":"Grady Jarrett","fieldposition":"DT","team":"ATL"},{"player":"Leonard
Floyd","fieldposition":"OLB","team":"LAR"},{"player":"Calais Campbell","fieldposition":"DE","team":"BAL"},{"player":"Tyrod Taylor","fieldposition":"QB","team":"LAC"},{"player":"Connor
McGovern","fieldposition":"OG","team":"NYJ"},{"player":"Mark Glowinski","fieldposition":"OG","team":"IND"},{"player":"Shaq Mason","fieldposition":"G","team":"NWE"},{"player":"Alejandro
Villanueva","fieldposition":"T","team":"PIT"},{"player":"Quandre Diggs","fieldposition":"CB","team":"SEA"},{"player":"Andrew Whitworth","fieldposition":"T","team":"LAR"},{"player":"Jack
Conklin","fieldposition":"OT","team":"CLE"},{"player":"Robert Woods","fieldposition":"WR","team":"LAR"},{"player":"K.J. Wright","fieldposition":"LB","team":"SEA"},{"player":"Richie
Incognito","fieldposition":"G","team":"LVR"},{"player":"Adam Thielen","fieldposition":"WR","team":"MIN"},{"player":"William Gholston","fieldposition":"DE","team":"TAM"},{"player":"Jamon
Brown","fieldposition":"OT","team":"PHI"},{"player":"A.J. Cann","fieldposition":"OG","team":"JAX"},{"player":"Buster Skrine","fieldposition":"DB","team":"CHI"},{"player":"Lamarcus
Joyner","fieldposition":"CB","team":"LVR"},{"player":"George Fant","fieldposition":"T","team":"NYJ"},{"player":"Tevin Coleman","fieldposition":"RB","team":"SFO"},{"player":"Kyle
Fuller","fieldposition":"CB","team":"CHI"},{"player":"Nick Easton","fieldposition":"C","team":"NOR"},{"player":"Desmond Trufant","fieldposition":"CB","team":"DET"},{"player":"Bradley
Roby","fieldposition":"CB","team":"HOU"},{"player":"Nick Boyle","fieldposition":"TE","team":"BAL"},{"player":"Cole Beasley","fieldposition":"WR","team":"BUF"},{"player":"Preston
Smith","fieldposition":"DE","team":"GNB"},{"player":"Robbie Gould","fieldposition":"K","team":"SFO"},{"player":"Jaquiski Tartt","fieldposition":"SS","team":"SFO"},{"player":"Cameron
Brate","fieldposition":"TE","team":"TAM"},{"player":"Kenny Vaccaro","fieldposition":"FS","team":"TEN"},{"player":"Brandon Williams","fieldposition":"DT","team":"BAL"},{"player":"Tyler
Boyd","fieldposition":"WR","team":"CIN"},{"player":"Matthew Ioannidis","fieldposition":"DT","team":"WAS"},{"player":"Cordarrelle Patterson","fieldposition":"WR","team":"CHI"},{"player":"Malcom
Brown","fieldposition":"DT","team":"NOR"},{"player":"Jarran Reed","fieldposition":"DT","team":"SEA"},{"player":"Fletcher Cox","fieldposition":"DT","team":"PHI"},{"player":"Kareem
Hunt","fieldposition":"RB","team":"CLE"},{"player":"Jamie Collins","fieldposition":"OLB","team":"DET"},{"player":"Ka'imi Fairbairn","fieldposition":"K","team":"HOU"},{"player":"Blake
Martinez","fieldposition":"ILB","team":"NYG"},{"player":"Micah Hyde","fieldposition":"CB","team":"BUF"},{"player":"Halapoulivaati Vaitai","fieldposition":"OT","team":"DET"},{"player":"Shaq
Thompson","fieldposition":"OLB","team":"CAR"},{"player":"Mark Ingram","fieldposition":"RB","team":"BAL"},{"player":"Vince Williams","fieldposition":"ILB","team":"PIT"},{"player":"Nick
Foles","fieldposition":"QB","team":"CHI"},{"player":"J.C. Tretter","fieldposition":"OG","team":"CLE"},{"player":"Mike Evans","fieldposition":"WR","team":"TAM"},{"player":"Robby
Anderson","fieldposition":"WR","team":"CAR"},{"player":"Shawn Williams","fieldposition":"SS","team":"CIN"},{"player":"James Bradberry","fieldposition":"CB","team":"NYG"},{"player":"Jesse
Davis","fieldposition":"T","team":"MIA"},{"player":"Jesse James","fieldposition":"TE","team":"DET"},{"player":"Jakeem Grant","fieldposition":"WR","team":"MIA"},{"player":"Randall
Cobb","fieldposition":"WR","team":"HOU"},{"player":"Emmanuel Ogbah","fieldposition":"DE","team":"MIA"},{"player":"James Carpenter","fieldposition":"LG","team":"ATL"},{"player":"Quinton
Jefferson","fieldposition":"DT","team":"BUF"},{"player":"Johnathan Hankins","fieldposition":"DT","team":"LVR"},{"player":"Willie Snead","fieldposition":"WR","team":"BAL"},{"player":"Bradley
McDougald","fieldposition":"FS","team":"NYJ"},{"player":"Daniel Sorensen","fieldposition":"S","team":"KAN"},{"player":"Shamar Stephen","fieldposition":"DT","team":"MIN"},{"player":"Duke
Johnson","fieldposition":"RB","team":"HOU"},{"player":"Jake Matthews","fieldposition":"OT","team":"ATL"},{"player":"Justin Tucker","fieldposition":"K","team":"BAL"},{"player":"Vic
Beasley","fieldposition":"OLB","team":"2TM"},{"player":"Todd Gurley","fieldposition":"RB","team":"ATL"},{"player":"J.R. Sweezy","fieldposition":"G","team":"ARI"},{"player":"Johnny
Hekker","fieldposition":"P","team":"LAR"},{"player":"Jason Witten","fieldposition":"TE","team":"LVR"},{"player":"Duron Harmon","fieldposition":"FS","team":"DET"},{"player":"Abry
Jones","fieldposition":"DT","team":"JAX"},{"player":"Tyler Kroft","fieldposition":"TE","team":"BUF"},{"player":"Jalen Richard","fieldposition":"RB","team":"LVR"},{"player":"Julian
Edelman","fieldposition":"WR","team":"NWE"},{"player":"Adam Butler","fieldposition":"DT","team":"NWE"},{"player":"Elijah Wilkinson","fieldposition":"OT","team":"DEN"},{"player":"Nicholas
Morrow","fieldposition":"LB","team":"LVR"},{"player":"Jacob Hollister","fieldposition":"TE","team":"SEA"},{"player":"Michael Davis","fieldposition":"","team":"LAC"},{"player":"Matt
Feiler","fieldposition":"T","team":"PIT"},{"player":"Zane Gonzalez","fieldposition":"K","team":"ARI"},{"player":"Roy Robertson-Harris","fieldposition":"DE","team":"CHI"},{"player":"Keelan
Cole","fieldposition":"WR","team":"JAX"},{"player":"Mike Hilton","fieldposition":"CB","team":"PIT"},{"player":"Kendrick Bourne","fieldposition":"WR","team":"SFO"},{"player":"Eric
```

Update requirements.txt File

With all the new libraries we installed, we need to update our requirements.txt file.

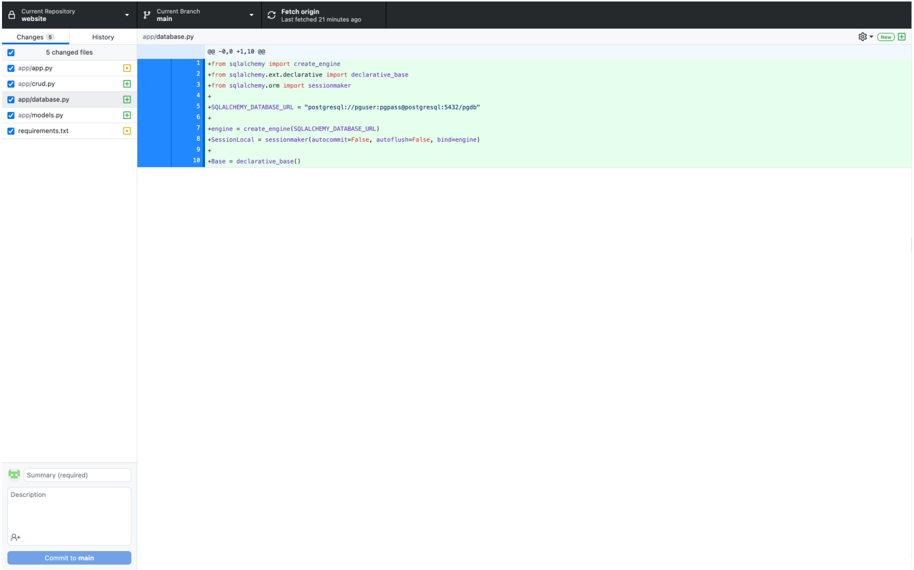
```
python -m pip freeze > requirements.txt
```



```
anyio==3.2.1
asgiref==3.3.4
async-exit-stack==1.0.1
async-generator==1.10
click==8.0.1
fastapi==0.65.1
FastAPI-SQLAlchemy==0.2.1
greenlet==1.1.0
h11==0.12.0
idna==3.2
psycopg2-binary==2.9.1
pydantic==1.8.2
sniffio==1.2.0
SQLAlchemy==1.4.21
starlette==0.14.2
typing-extensions==3.10.0.0
uvicorn==0.14.0
```

We are now ready to update our Github account.

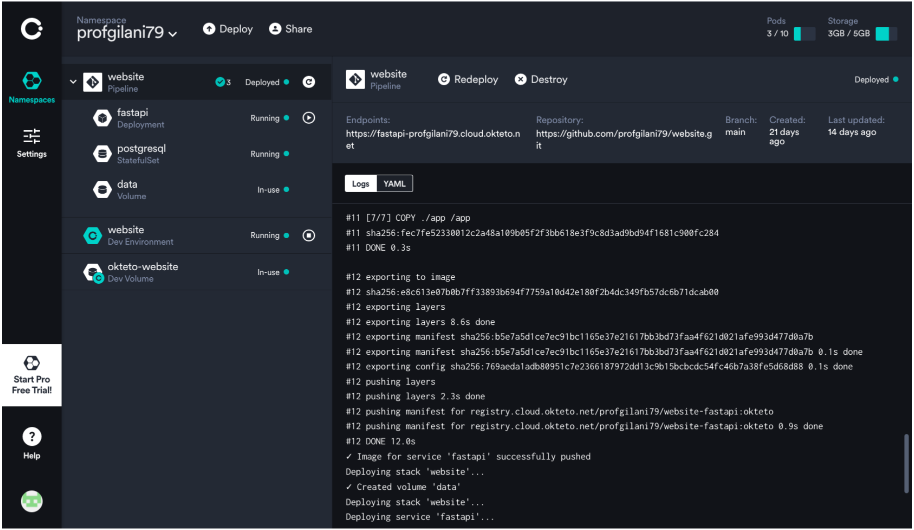
Upload into Github



☑ 5 changed files
☑ app/app.py
☑ app/crud.py
☑ app/database.py
☑ app/models.py
☑ requirements.txt

```
@@ -0,0 +1,10 @@
+from sqlalchemy import create_engine
+from sqlalchemy.ext.declarative import declarative_base
+from sqlalchemy.orm import sessionmaker
+
+SQLALCHEMY_DATABASE_URL = "postgresql://pguser:pgpass@postgresql:5432/pgdb"
+
+engine = create_engine(SQLALCHEMY_DATABASE_URL)
+SessionLocal = sessionmaker(autocommit=False, autoflush=False, bind=engine)
+
+Base = declarative_base()
```

Redeploy into Okteto



Namespace: profgilani79

Pods: 3 / 10

Storage: 3GB / 5GB

website Pipeline	✓3	Deployed ●
fastapi Deployment		Running ●
postgresql StatefulSet		Running ●
data Volume		In-use ●
website Dev Environment		Running ●
okteto-website Dev Volume		In-use ●

website
Pipeline

Deployed ●

Endpoints: https://fastapi-profgilani79.cloud.okteto.net

Repository: https://github.com/profgilani79/website.git

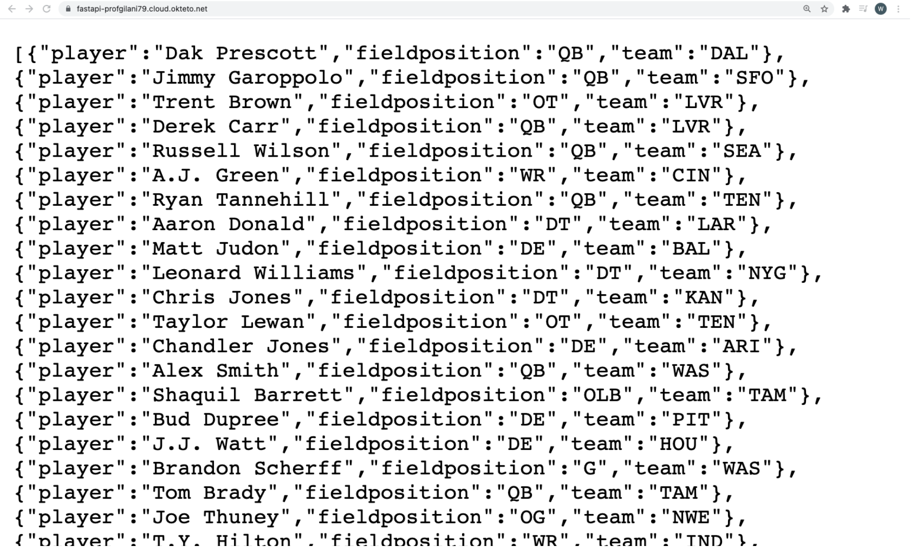
Branch: main

Created: 21 days ago

Last updated: 14 days ago

```
#11 [7/7] COPY ./app /app
#11 sha256:fec7fe52330012c2a48a109b05f2f3bb618e3f9c8d3ad9bd94f1681c900fc284
#11 DONE 0.3s

#12 exporting to image
#12 sha256:e8c613e07b0b7ff33893b694f7759a10d42e180f2b4dc349fb57dc6b71dcab00
#12 exporting layers
#12 exporting layers 8.6s done
#12 exporting manifest sha256:b5e7a5d1ce7ec91bc1165e37e21617bb3bd73faa4f621d021afe993d477d0a7b
#12 exporting manifest sha256:b5e7a5d1ce7ec91bc1165e37e21617bb3bd73faa4f621d021afe993d477d0a7b 0.1s done
#12 exporting config sha256:769aeda1adb80951c7e2366187972dd13c9b15bcbcdc54fc46b7a38fe5d68d88 0.1s done
#12 pushing layers
#12 pushing layers 2.3s done
#12 pushing manifest for registry.cloud.okteto.net/profgilani79/website-fastapi:okteto
#12 pushing manifest for registry.cloud.okteto.net/profgilani79/website-fastapi:okteto 0.9s done
#12 DONE 12.0s
✓ Image for service 'fastapi' successfully pushed
Deploying stack 'website'...
✓ Created volume 'data'
Deploying stack 'website'...
Deploying service 'fastapi'...
```

Click on URL



```
[{"player":"Dak Prescott","fieldposition":"QB","team":"DAL"},
{"player":"Jimmy Garoppolo","fieldposition":"QB","team":"SFO"},
{"player":"Trent Brown","fieldposition":"OT","team":"LVR"},
{"player":"Derek Carr","fieldposition":"QB","team":"LVR"},
{"player":"Russell Wilson","fieldposition":"QB","team":"SEA"},
{"player":"A.J. Green","fieldposition":"WR","team":"CIN"},
{"player":"Ryan Tannehill","fieldposition":"QB","team":"TEN"},
{"player":"Aaron Donald","fieldposition":"DT","team":"LAR"},
{"player":"Matt Judon","fieldposition":"DE","team":"BAL"},
{"player":"Leonard Williams","fieldposition":"DT","team":"NYG"},
{"player":"Chris Jones","fieldposition":"DT","team":"KAN"},
{"player":"Taylor Lewan","fieldposition":"OT","team":"TEN"},
{"player":"Chandler Jones","fieldposition":"DE","team":"ARI"},
{"player":"Alex Smith","fieldposition":"QB","team":"WAS"},
{"player":"Shaquil Barrett","fieldposition":"OLB","team":"TAM"},
{"player":"Bud Dupree","fieldposition":"DE","team":"PIT"},
{"player":"J.J. Watt","fieldposition":"DE","team":"HOU"},
{"player":"Brandon Scherff","fieldposition":"G","team":"WAS"},
{"player":"Tom Brady","fieldposition":"QB","team":"TAM"},
{"player":"Joe Thuney","fieldposition":"OG","team":"NWE"},
{"player":"T.Y. Hilton","fieldposition":"WR","team":"IND"},
```