

Final Project: Final Report

Project Group: Python Group

Student Name: Sandeep Kumar Paul

Project Name: SqlAtlas Data-Analysis Web App

Provisioning an Azure VM with Ubuntu 20.04 Linux Operating System via Azure-Portal:

The screenshot displays the Microsoft Azure portal interface. The left sidebar contains navigation options such as 'Create a resource', 'Home', 'Dashboard', 'All services', and 'FAVORITES'. The main content area shows the 'Overview' tab for a virtual machine named 'sqlatlas'. The 'Essentials' section provides key details: Resource group (atlas), Status (Running), Location (East US), Subscription (Azure for Students), and Subscription ID. The 'Properties' tab is active, showing details for the 'Virtual machine' and 'Networking' sections.

Section	Property	Value
Virtual machine	Computer name	sqlatlas
	Health state	-
	Operating system	Linux (ubuntu 20.04)
	Publisher	canonical
	Offer	0001-com-ubuntu-server-focal
	Plan	20_04-lts-gen2
	VM generation	V2
	Agent status	Ready
	Agent version	2.5.0.2
	Host group	None
Networking	Public IP address	20.120.94.146
	Public IP address (IPv6)	-
	Private IP address	10.0.0.4
	Private IP address (IPv6)	-
	Virtual network/subnet	atlas-vnet/default

Additional details visible in the 'Networking' section include the DNS name 'Configure' and the 'Size' section showing 'Standard D4s v3' with 4 vCPUs and 16 GiB RAM.

Configuring the Virtual Machine Firewall to access the SSH and HTTP for Web-Hosting:

The screenshot displays the Microsoft Azure portal interface. The left sidebar contains navigation options such as 'Create a resource', 'Home', 'Dashboard', 'All services', and 'FAVORITES'. The main content area is titled 'sqlatlas | Networking' and shows the 'Networking' settings for the virtual machine 'sqlatlas'. The 'Network Interface' is 'sqlatlas539', and the 'IP configuration' is 'ipconfig1 (Primary)'. The 'Network security group' is 'sqlatlas-nsg'. The 'Inbound port rules' section is active, showing a table of rules. The table has columns for Priority, Name, Port, Protocol, Source, Destination, and Action. The rules are: SSH (Priority 300, Port 22, TCP, Any, Any, Allow), Port_8080 (Priority 310, Port 80, TCP, Any, Any, Allow), AllowVnetInBound (Priority 65000, Any, Any, VirtualNetwork, VirtualNetwork, Allow), AllowAzureLoadBalancerInBound (Priority 65001, Any, Any, AzureLoadBalancer, Any, Allow), and DenyAllInBound (Priority 65500, Any, Any, Any, Any, Deny). A blue button 'Add inbound port rule' is visible in the top right of the rules section.

Microsoft Azure

Search resources, services, and docs (G+/)

Home > sqlatlas

sqlatlas | Networking

Virtual machine

Search (Ctrl+/)

Attach network interface Detach network interface Feedback

sqlatlas539

IP configuration ⓘ
ipconfig1 (Primary)

Network Interface: sqlatlas539 Effective security rules Troubleshoot VM connection issues Topology

Virtual network/subnet: atlas-vnet/default NIC Public IP: 20.120.94.146 NIC Private IP: 10.0.0.4 Accelerated networking: Enabled

Inbound port rules Outbound port rules Application security groups Load balancing

Network security group sqlatlas-nsg (attached to network interface: sqlatlas539)
Impacts 0 subnets, 1 network interfaces

Add inbound port rule

Priority	Name	Port	Protocol	Source	Destination	Action
300	SSH	22	TCP	Any	Any	Allow
310	Port_8080	80	TCP	Any	Any	Allow
65000	AllowVnetInBound	Any	Any	VirtualNetwork	VirtualNetwork	Allow
65001	AllowAzureLoadBalancerInBound	Any	Any	AzureLoadBalancer	Any	Allow
65500	DenyAllInBound	Any	Any	Any	Any	Deny

Configuring the Azure SQL Database firewall to allow the above created Azure VM to access the DB resources:

The screenshot shows the Microsoft Azure portal interface. The left sidebar contains navigation links: Create a resource, Home, Dashboard, All services, FAVORITES, All resources, Resource groups, App Services, Function App, SQL databases, Azure Cosmos DB, Virtual machines, Load balancers, Storage accounts, Virtual networks, Azure Active Directory, Monitor, Advisor, Microsoft Defender for Cloud, and Cost Management +.

The main content area displays the 'Firewall settings' for the 'sxp82050@ucmo.edu' SQL server. The settings include:

- ☐ Deny public network access
- Minimum TLS Version: 1.0, 1.1, 1.2 (selected)
- Connection Policy: Default (selected), Proxy, Redirect
- Allow Azure services and resources to access this server: Yes, No (selected)
- Client IP address: 97.88.164.154

A table lists the rules:

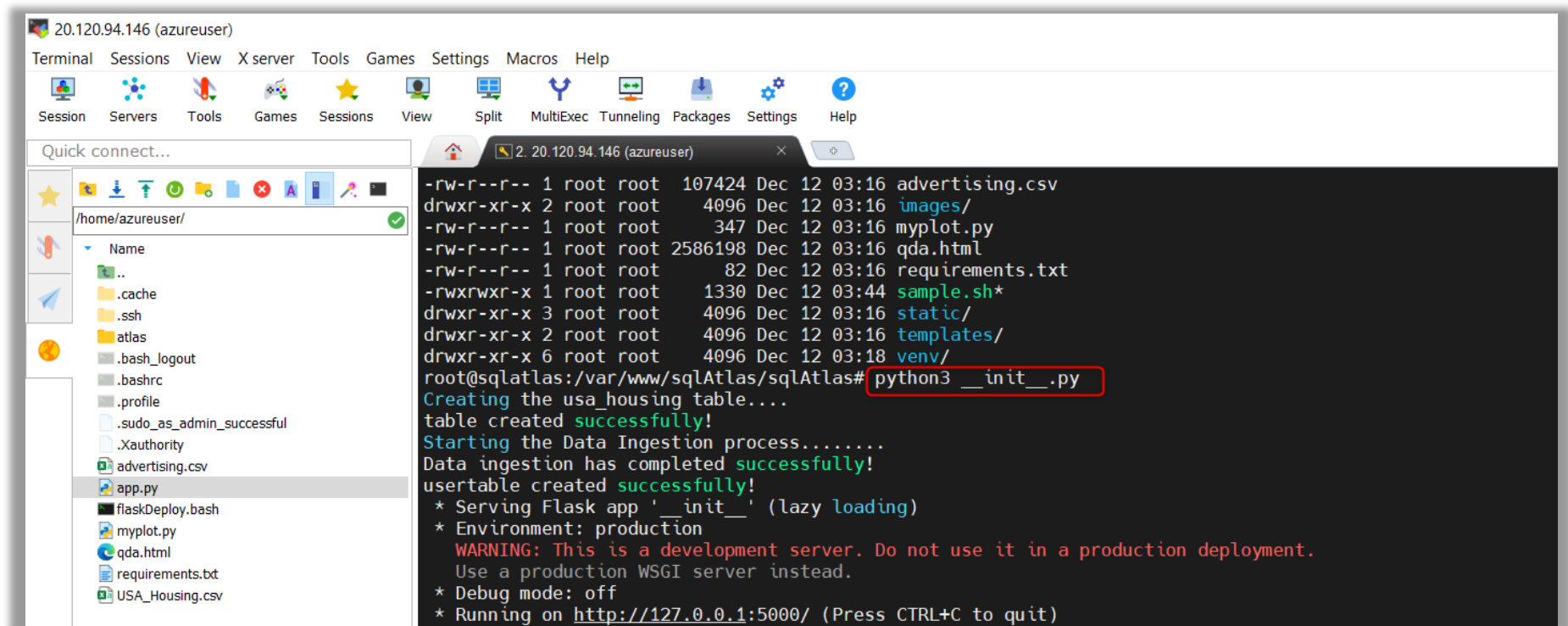
Rule name	Start IP	End IP	
			...
ClientIPAddress_2021-12-11...	20.120.94.146	20.120.94.146	...
query-editor-a1e6c9	97.88.164.154	97.88.164.154	...

Virtual networks

+ Add existing virtual network + Create new virtual network

Rule name	Virtual network	Subnet	Address Range	Endpoint status
No vnet rules for this server.				

This is a test on Azure VM to check if there is any error in Python code while running the application:

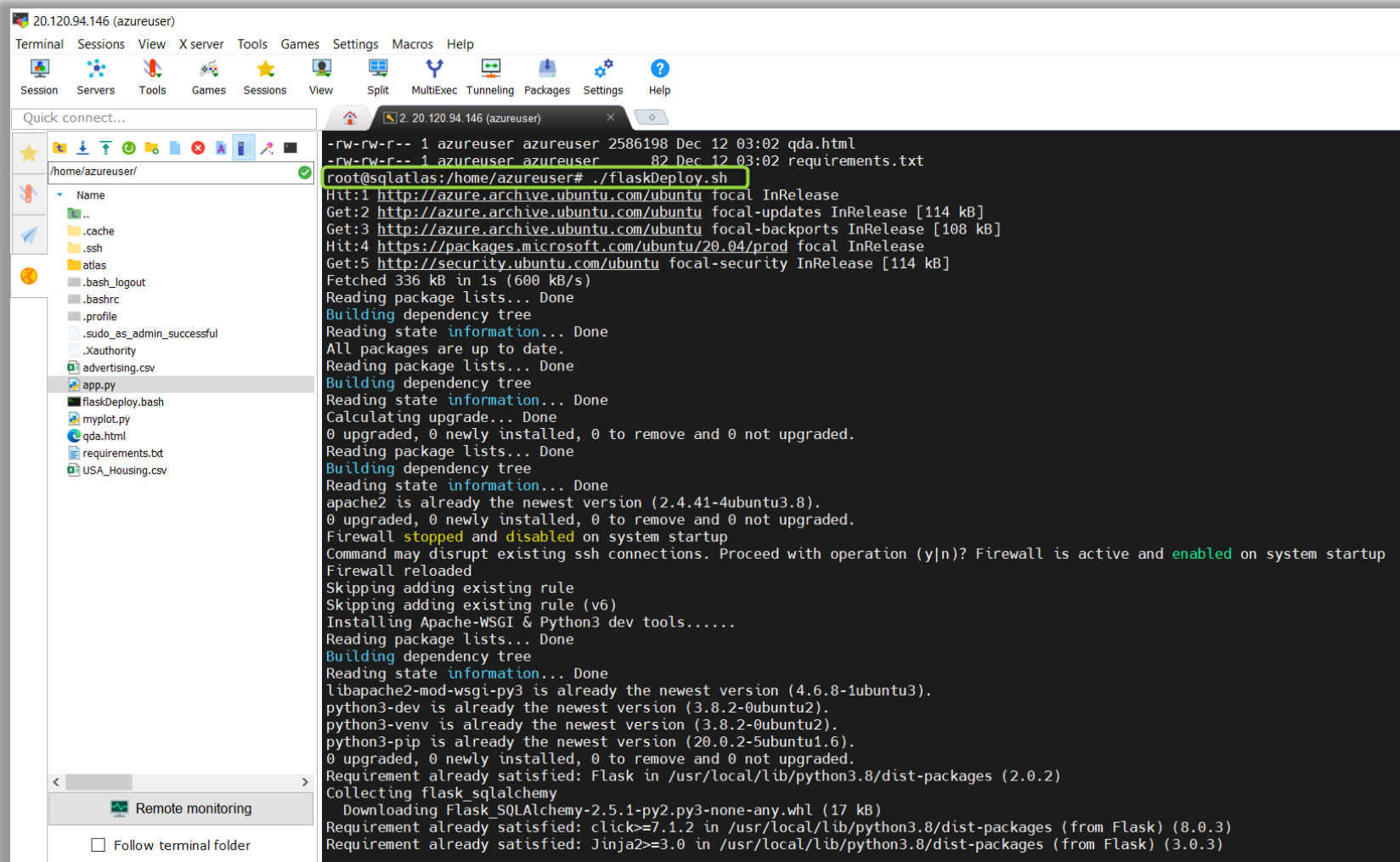


```
20.120.94.146 (azureuser)
Terminal Sessions View X server Tools Games Settings Macros Help
Session Servers Tools Games Sessions View Split MultiExec Tunneling Packages Settings Help

Quick connect...
/home/azureuser/
Name
..
.cache
.ssh
atlas
.bash_logout
.bashrc
.profile
.sudo_as_admin_successful
.Xauthority
advertising.csv
app.py
flaskDeploy.bash
myplot.py
qda.html
requirements.txt
USA_Housing.csv

-rw-r--r-- 1 root root 107424 Dec 12 03:16 advertising.csv
drwxr-xr-x 2 root root 4096 Dec 12 03:16 images/
-rw-r--r-- 1 root root 347 Dec 12 03:16 myplot.py
-rw-r--r-- 1 root root 2586198 Dec 12 03:16 qda.html
-rw-r--r-- 1 root root 82 Dec 12 03:16 requirements.txt
-rwxrwxr-x 1 root root 1330 Dec 12 03:44 sample.sh*
drwxr-xr-x 3 root root 4096 Dec 12 03:16 static/
drwxr-xr-x 2 root root 4096 Dec 12 03:16 templates/
drwxr-xr-x 6 root root 4096 Dec 12 03:18 venv/
root@sqlatlas:/var/www/sqlAtlas/sqlAtlas# python3 __init__.py
Creating the usa_housing table...
table created successfully!
Starting the Data Ingestion process.....
Data ingestion has completed successfully!
usertable created successfully!
* Serving Flask app '__init__' (lazy loading)
* Environment: production
WARNING: This is a development server. Do not use it in a production deployment.
Use a production WSGI server instead.
* Debug mode: off
* Running on http://127.0.0.1:5000/ (Press CTRL+C to quit)
```

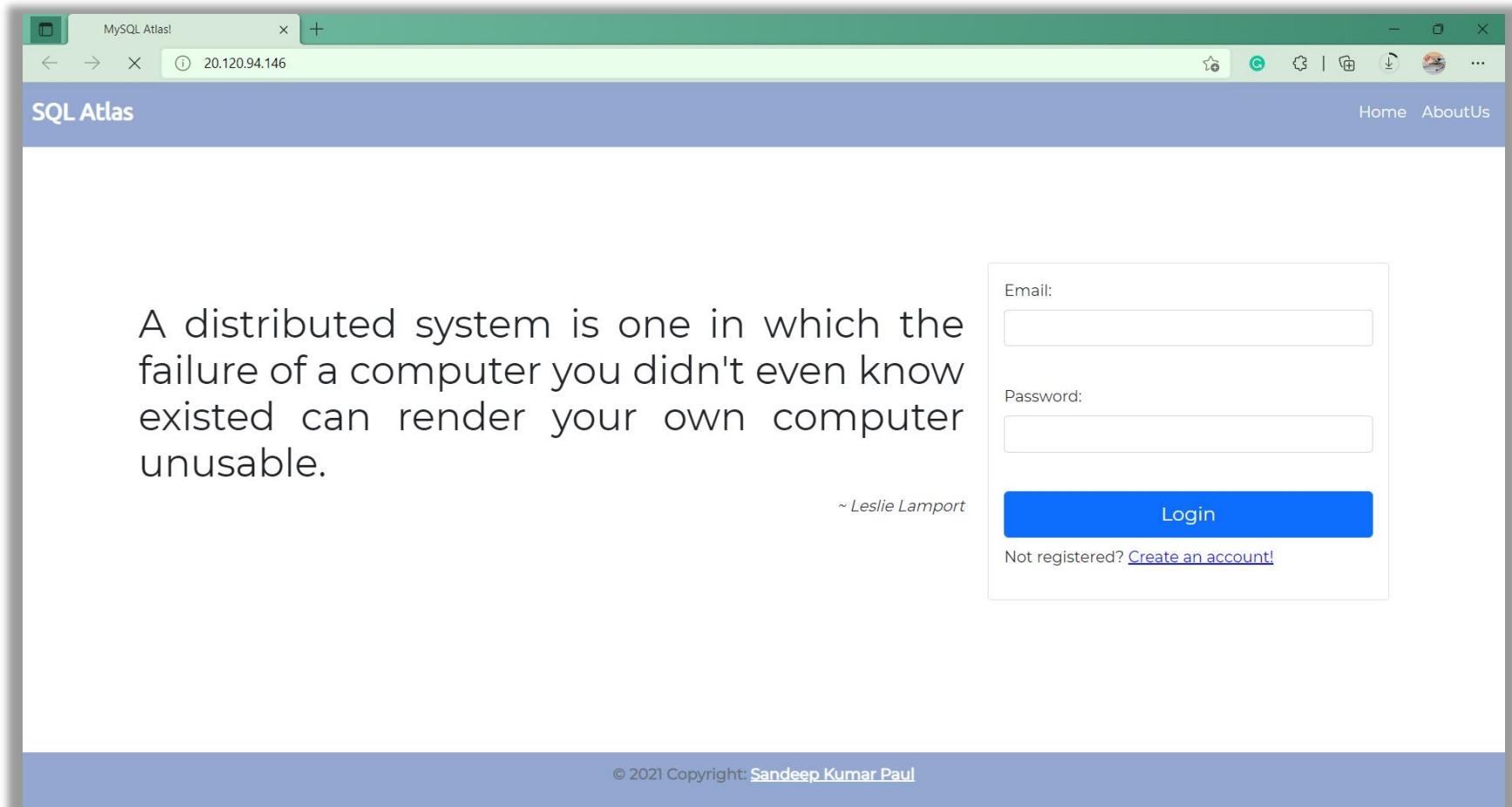
Running the Deployment script and manually copying the Python files into the VM:



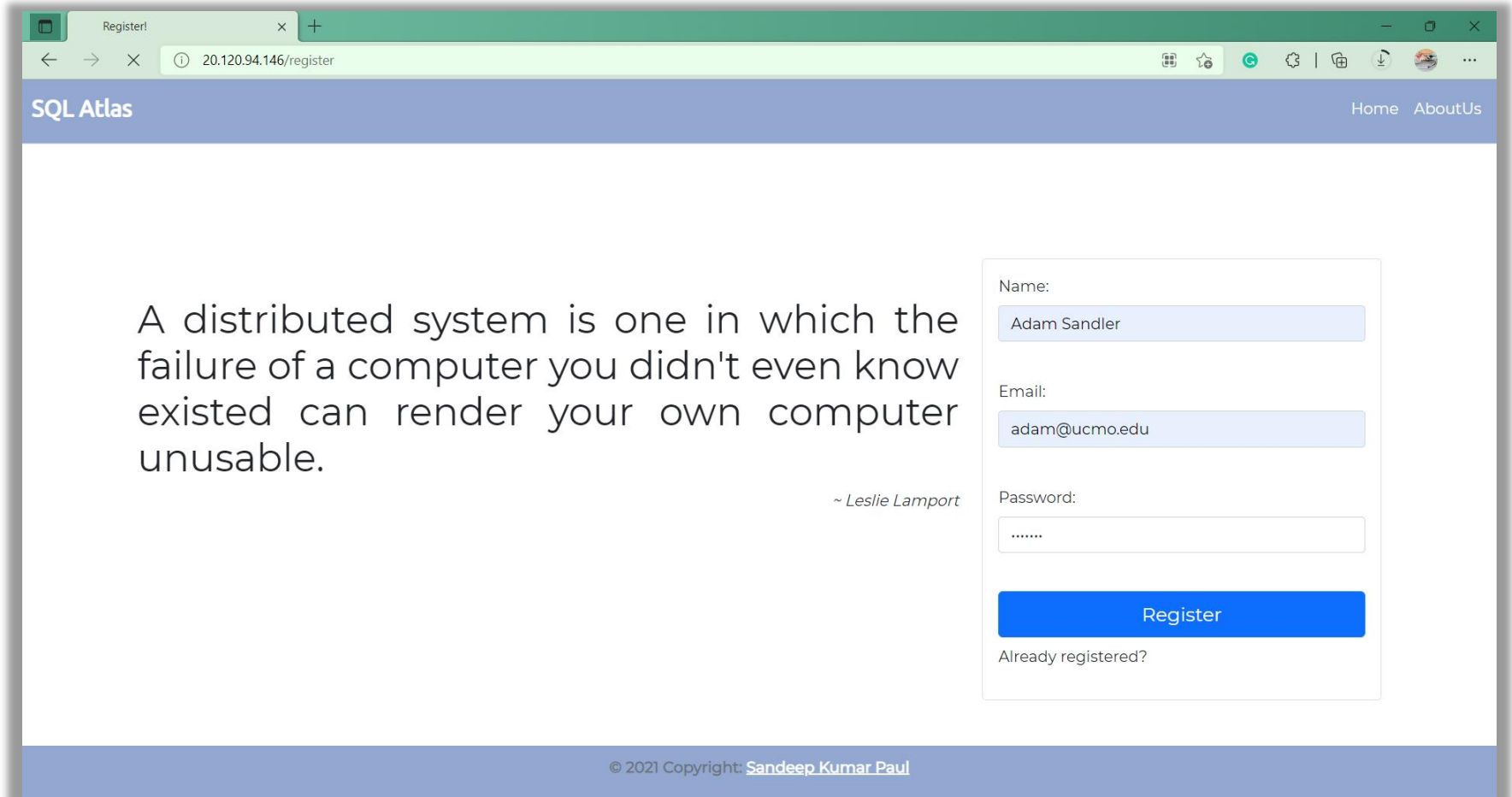
The screenshot shows a terminal window titled "20.120.94.146 (azureuser)". The left sidebar displays a file explorer for the "/home/azureuser/" directory, listing files such as ".cache", ".ssh", "atlas", ".bash_logout", ".bashrc", ".profile", ".sudo_as_admin_successful", ".Xauthority", "advertising.csv", "app.py", "flaskDeploy.bash", "myplot.py", "qda.html", "requirements.txt", and "USA_Housing.csv". The main terminal area shows the execution of the script `./flaskDeploy.sh`. The script performs several actions: it updates the system, builds a dependency tree, and installs Apache-WSGI and Python3 dev tools. It also checks for updates and installs Flask and SQLAlchemy. The output of the script is as follows:

```
-rw-rw-r-- 1 azureuser azureuser 2586198 Dec 12 03:02 qda.html
-rw-rw-r-- 1 azureuser azureuser 82 Dec 12 03:02 requirements.txt
root@sqlatlas:/home/azureuser# ./flaskDeploy.sh
Hit:1 http://azure.archive.ubuntu.com/ubuntu focal InRelease
Get:2 http://azure.archive.ubuntu.com/ubuntu focal-updates InRelease [114 kB]
Get:3 http://azure.archive.ubuntu.com/ubuntu focal-backports InRelease [108 kB]
Hit:4 https://packages.microsoft.com/ubuntu/20.04/prod focal InRelease
Get:5 http://security.ubuntu.com/ubuntu focal-security InRelease [114 kB]
Fetched 336 kB in 1s (600 kB/s)
Reading package lists... Done
Building dependency tree
Reading state information... Done
All packages are up to date.
Reading package lists... Done
Building dependency tree
Reading state information... Done
Calculating upgrade... Done
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
Reading package lists... Done
Building dependency tree
Reading state information... Done
apache2 is already the newest version (2.4.41-4ubuntu3.8).
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
Firewall stopped and disabled on system startup
Command may disrupt existing ssh connections. Proceed with operation (y|n)? Firewall is active and enabled on system startup
Firewall reloaded
Skipping adding existing rule
Skipping adding existing rule (v6)
Installing Apache-WSGI & Python3 dev tools.....
Reading package lists... Done
Building dependency tree
Reading state information... Done
libapache2-mod-wsgi-py3 is already the newest version (4.6.8-1ubuntu3).
python3-dev is already the newest version (3.8.2-0ubuntu2).
python3-venv is already the newest version (3.8.2-0ubuntu2).
python3-pip is already the newest version (20.0.2-5ubuntu1.6).
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
Requirement already satisfied: Flask in /usr/local/lib/python3.8/dist-packages (2.0.2)
Collecting flask_sqlalchemy
  Downloading Flask_SQLAlchemy-2.5.1-py2.py3-none-any.whl (17 kB)
Requirement already satisfied: click>=7.1.2 in /usr/local/lib/python3.8/dist-packages (from Flask) (8.0.3)
Requirement already satisfied: Jinja2>=3.0 in /usr/local/lib/python3.8/dist-packages (from Flask) (3.0.3)
```

Home/Log in Page of the Web-App:



Registration Page:



The screenshot shows a web browser window with a single tab titled 'Register!'. The address bar displays '20.120.94.146/register'. The page header is a blue bar with 'SQL Atlas' on the left and 'Home AboutUs' on the right. The main content area has a white background. On the left, a quote reads: 'A distributed system is one in which the failure of a computer you didn't even know existed can render your own computer unusable.' followed by '~ Leslie Lamport'. On the right, a registration form is enclosed in a light gray box. It contains fields for 'Name:' (filled with 'Adam Sandler'), 'Email:' (filled with 'adam@ucmo.edu'), and 'Password:' (filled with seven dots). Below these fields is a blue 'Register' button and a link 'Already registered?'. The footer is a blue bar with the text '© 2021 Copyright: Sandeep Kumar Paul'.

Register!

20.120.94.146/register

SQL Atlas Home AboutUs

A distributed system is one in which the failure of a computer you didn't even know existed can render your own computer unusable.

~ Leslie Lamport

Name:
Adam Sandler

Email:
adam@ucmo.edu

Password:
.....

Register

[Already registered?](#)

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Post registration, this is a validation to check whether the record has been created on the database:

The screenshot shows the Microsoft Azure portal interface. The left sidebar contains navigation links for various services. The main area displays the 'atlas_db (sxpatlas/atlas_db) | Query editor (preview)' window. The 'Query editor' tab is active, showing two SQL queries. The first query is 'select count(*) from [dbo].[usa_housing]' and the second is 'select * from [dbo].[usertable]'. The results of the second query are displayed in a table with columns 'user_count', 'name', 'emailid', and 'password'. The first row of results shows 'user_count: 1', 'name: Adam Sandler', 'emailid: adam@ucmo.edu', and 'password: adam123'. A status bar at the bottom indicates 'Query succeeded 1.0s'.

Microsoft Azure

Search resources, services, and docs (G+)

Home > SQL databases > atlas_db (sxpatlas/atlas_db)

atlas_db (sxpatlas/atlas_db) | Query editor (preview)

SQL database

Search (Ctrl+ /)

Login + New Query ↑ Open query Feedback

Overview

Activity log

Tags

Diagnose and solve problems

Quick start

Query editor (preview)

Power Platform

Power BI

Power Apps

Power Automate

Settings

Compute + storage

Connection strings

Properties

Locks

Data management

Replicas

Showing limited object explorer here. For full capability please open SSDT.

Tables

dbo.usa_housing

Avg_Area_Income (float, not null)

Avg_Area_House_Age (float, not null)

Avg_Area_Number_of_Rooms (float, not null)

Avg_Area_Number_of_Bedrooms (float, not null)

Area_Population (float, not null)

Price (float, not null)

Address (varchar, null)

dbo.usertable

user_count (int, not null)

name (varchar, not null)

emailid (varchar, not null)

password (varchar, not null)

Views

Stored Procedures

Query 1

Run Cancel query Save query Export data as Show only Editor

```
1 select count(*) from [dbo].[usa_housing]
2
3 select * from [dbo].[usertable]
```

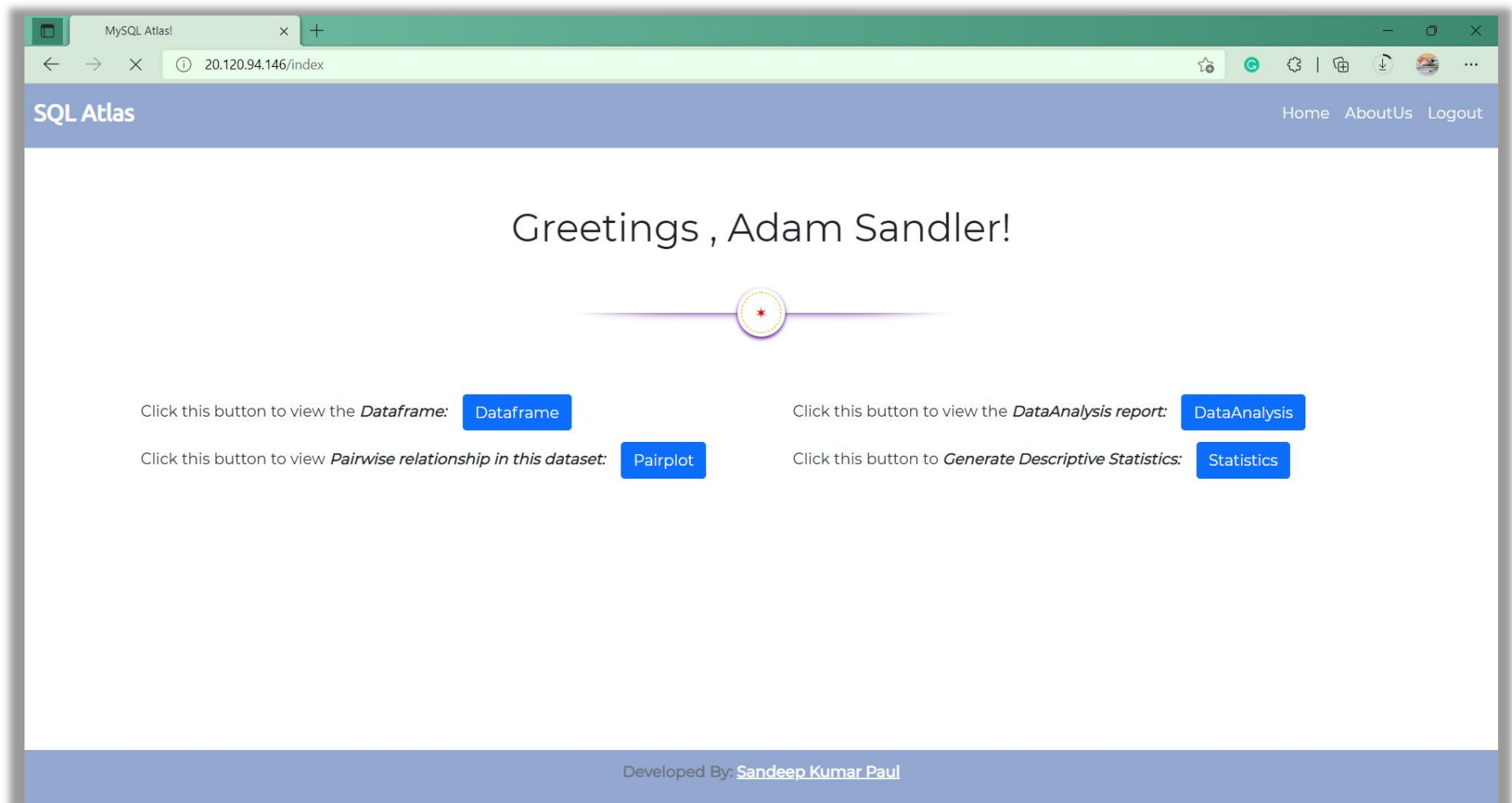
Results Messages

Search to filter items...

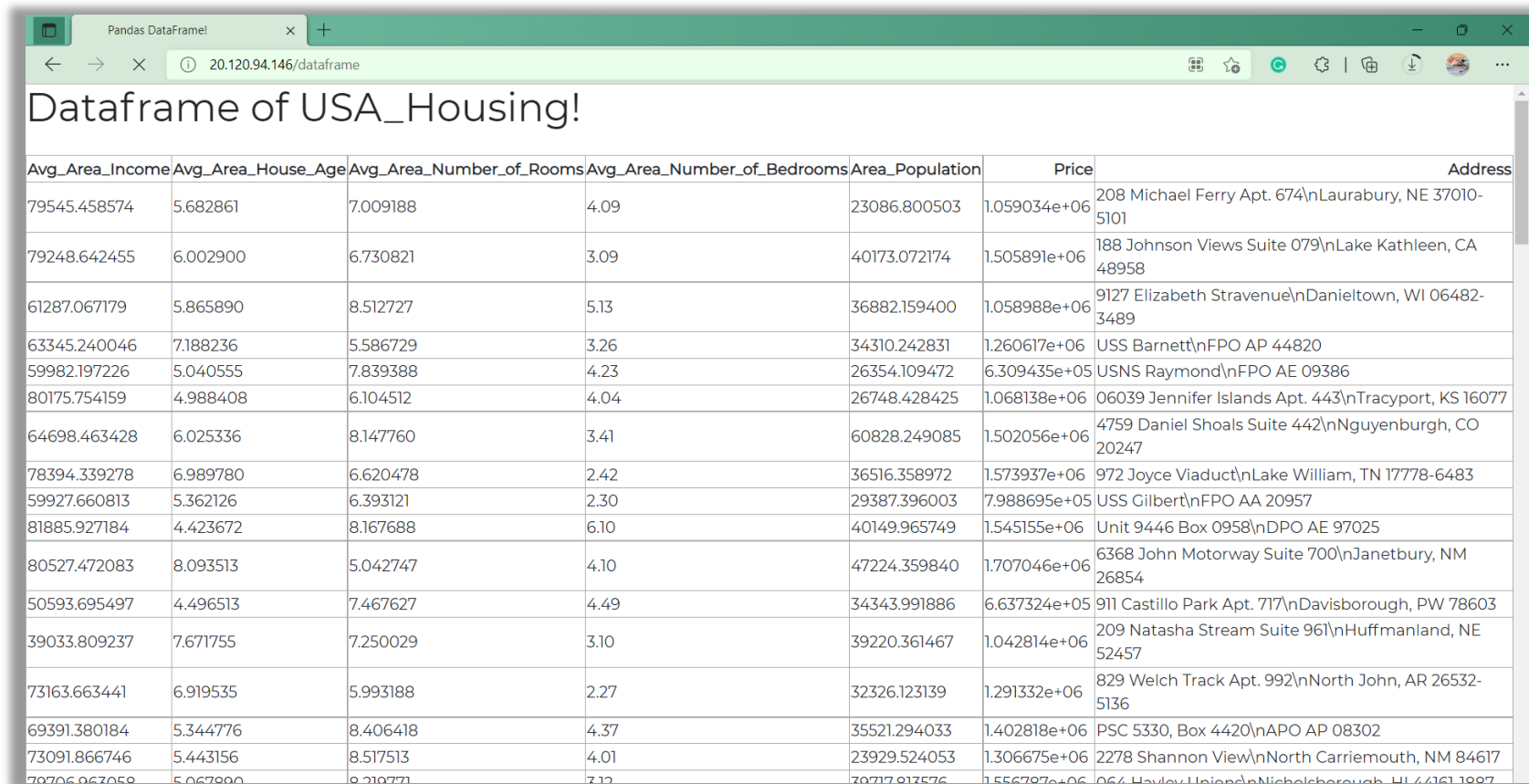
user_count	name	emailid	password
1	Adam Sandler	adam@ucmo.edu	adam123

Query succeeded 1.0s

User Dashboard Page:



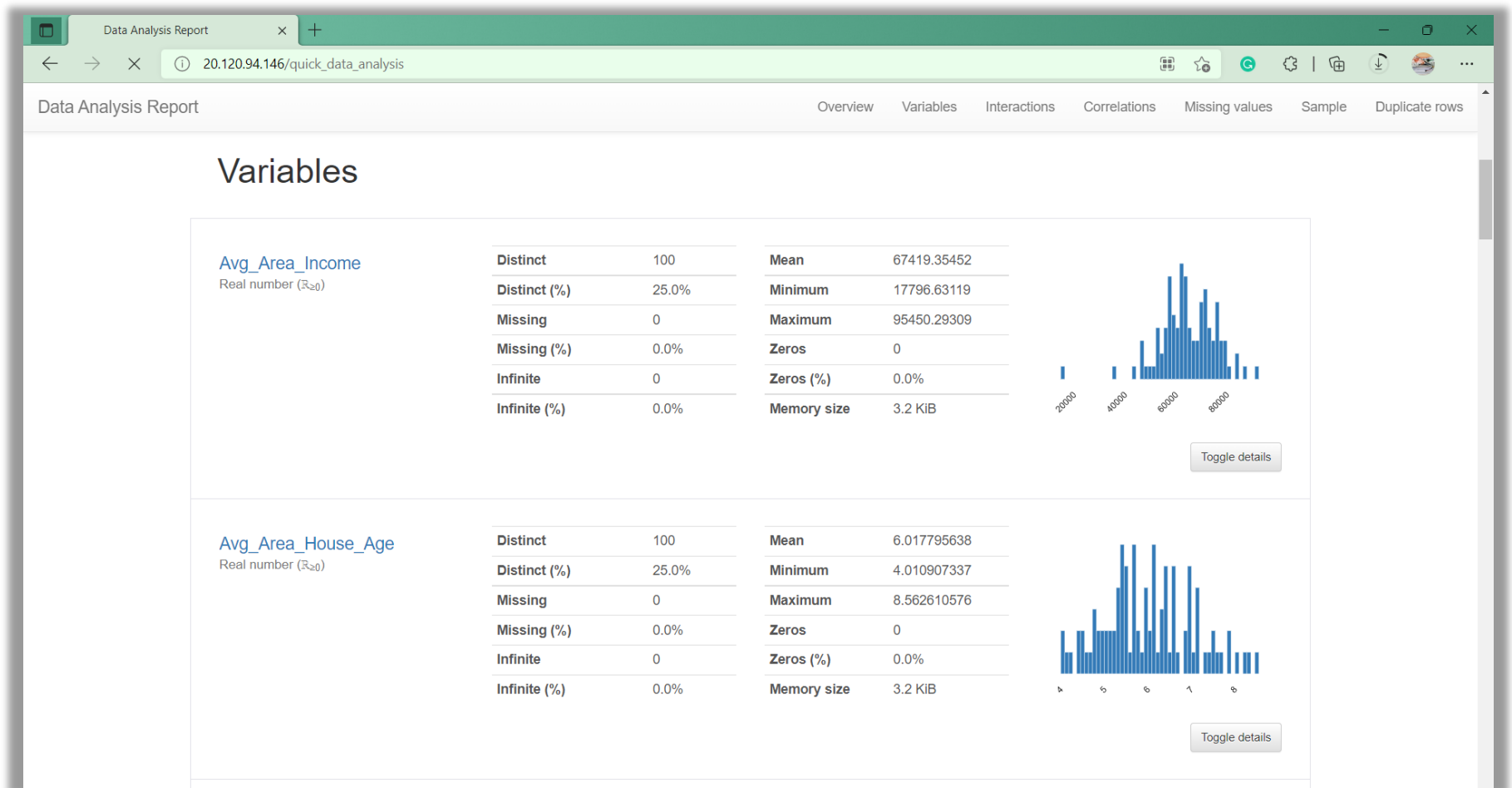
Page displaying the dataframe of the SQL table:



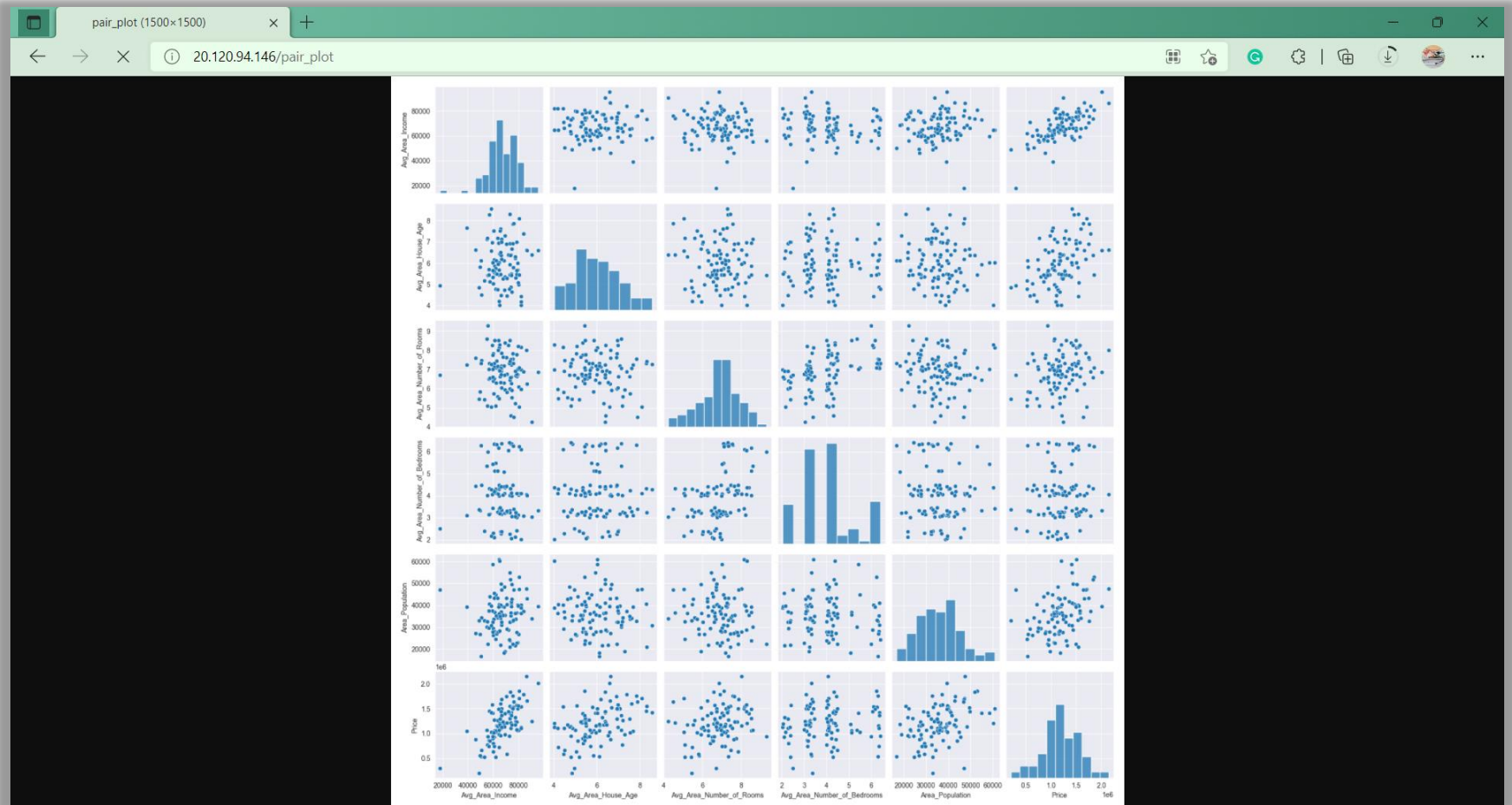
The image shows a web browser window with a single tab titled 'Pandas DataFrame!'. The address bar shows the URL '20.120.94.146/dataframe'. The main content area has a heading 'Dataframe of USA_Housing!' and displays a table with 7 columns: Avg_Area_Income, Avg_Area_House_Age, Avg_Area_Number_of_Rooms, Avg_Area_Number_of_Bedrooms, Area_Population, Price, and Address. The table contains 15 rows of housing data.

Avg_Area_Income	Avg_Area_House_Age	Avg_Area_Number_of_Rooms	Avg_Area_Number_of_Bedrooms	Area_Population	Price	Address
79545.458574	5.682861	7.009188	4.09	23086.800503	1.059034e+06	208 Michael Ferry Apt. 674\nLaurabury, NE 37010-5101
79248.642455	6.002900	6.730821	3.09	40173.072174	1.505891e+06	188 Johnson Views Suite 079\nLake Kathleen, CA 48958
61287.067179	5.865890	8.512727	5.13	36882.159400	1.058988e+06	9127 Elizabeth Stravenue\nDanieltown, WI 06482-3489
63345.240046	7.188236	5.586729	3.26	34310.242831	1.260617e+06	USS Barnett\nFPO AP 44820
59982.197226	5.040555	7.839388	4.23	26354.109472	6.309435e+05	USNS Raymond\nFPO AE 09386
80175.754159	4.988408	6.104512	4.04	26748.428425	1.068138e+06	06039 Jennifer Islands Apt. 443\nTracyport, KS 16077
64698.463428	6.025336	8.147760	3.41	60828.249085	1.502056e+06	4759 Daniel Shoals Suite 442\nNguyenburgh, CO 20247
78394.339278	6.989780	6.620478	2.42	36516.358972	1.573937e+06	972 Joyce Viaduct\nLake William, TN 17778-6483
59927.660813	5.362126	6.393121	2.30	29387.396003	7.988695e+05	USS Gilbert\nFPO AA 20957
81885.927184	4.423672	8.167688	6.10	40149.965749	1.545155e+06	Unit 9446 Box 0958\nDPO AE 97025
80527.472083	8.093513	5.042747	4.10	47224.359840	1.707046e+06	6368 John Motorway Suite 700\nJanetbury, NM 26854
50593.695497	4.496513	7.467627	4.49	34343.991886	6.637324e+05	911 Castillo Park Apt. 717\nDavisborough, PW 78603
39033.809237	7.671755	7.250029	3.10	39220.361467	1.042814e+06	209 Natasha Stream Suite 961\nHuffmanland, NE 52457
73163.663441	6.919535	5.993188	2.27	32326.123139	1.291332e+06	829 Welch Track Apt. 992\nNorth John, AR 26532-5136
69391.380184	5.344776	8.406418	4.37	35521.294033	1.402818e+06	PSC 5330, Box 4420\nAPO AP 08302
73091.866746	5.443156	8.517513	4.01	23929.524053	1.306675e+06	2278 Shannon View\nNorth Carriemouth, NM 84617
79706.967058	5.067890	8.210771	7.12	79717.917576	1.556787e+06	064 Hayley Union\nNicholsborough, HI 44161-1887

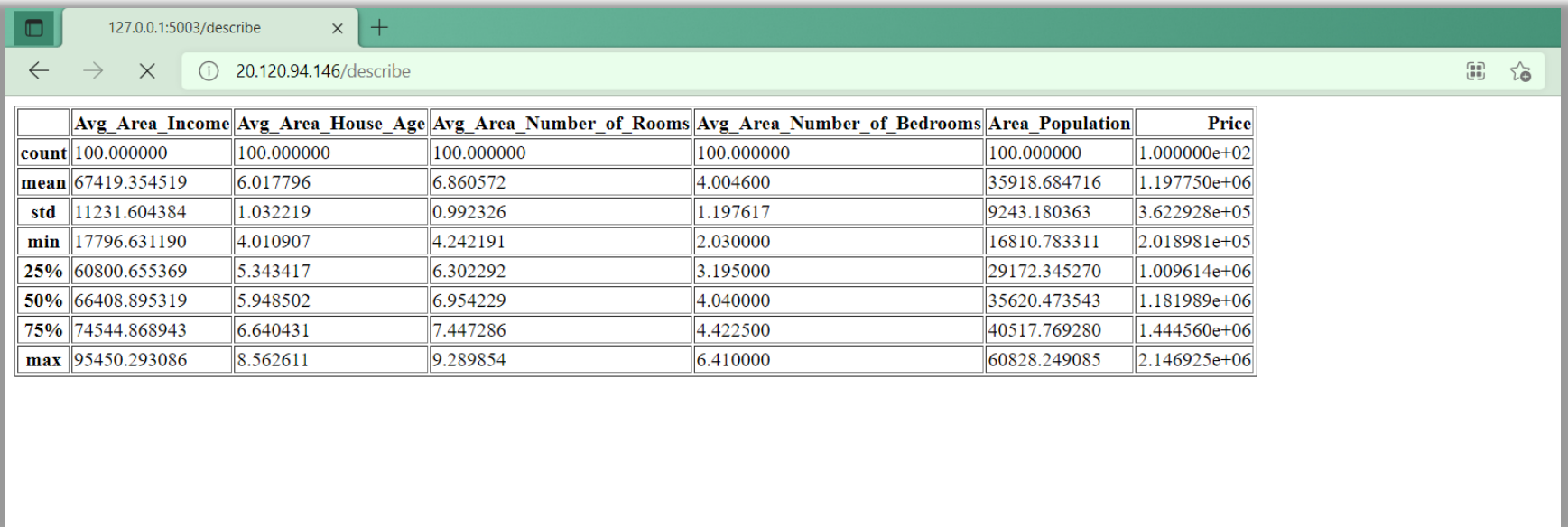
Page displaying the Descriptive Analysis report of the SQL table:



Page displaying the PairPlot of the SQL table:



Page displaying the Statistical Values of the SQL table:



	Avg_Area_Income	Avg_Area_House_Age	Avg_Area_Number_of_Rooms	Avg_Area_Number_of_Bedrooms	Area_Population	Price
count	100.000000	100.000000	100.000000	100.000000	100.000000	1.000000e+02
mean	67419.354519	6.017796	6.860572	4.004600	35918.684716	1.197750e+06
std	11231.604384	1.032219	0.992326	1.197617	9243.180363	3.622928e+05
min	17796.631190	4.010907	4.242191	2.030000	16810.783311	2.018981e+05
25%	60800.655369	5.343417	6.302292	3.195000	29172.345270	1.009614e+06
50%	66408.895319	5.948502	6.954229	4.040000	35620.473543	1.181989e+06
75%	74544.868943	6.640431	7.447286	4.422500	40517.769280	1.444560e+06
max	95450.293086	8.562611	9.289854	6.410000	60828.249085	2.146925e+06