A RESEARCH ON DATABASE TESTING

DATABASE:

1. A database is an organized collection of data stored electronically and managed by a Data Base Management System (DBMS).
2. A DBMS manages and controls access to a DB. Examples include MongoDB, MariaDB, SQL.

DATABASE TESTING:

1. Database testing is the process of verifying the accuracy, reliability and performance of a Data Base system.
2. It can be performed manually, automatically and in a hybrid way (combined procedure of automation and manual).
3. It is also called as backend testing as it mainly focuses on the server side which isn't visible to the user.

IMPORTANCE OF DATABASE TESTING:

Database testing saves data loss and aborted transaction data

Transaction here refers to the access and retrieval of data and transaction follows a few properties like:

1. ATOMICITY: If any transaction is performed on data, it should happen completely or shouldn't be implemented.
2. CONSISTENCY: Database must be valid and preserved after the transaction is complete.
3. DURABILITY: Modifications will be kept without any fail when the transaction is committed.
4. ISOLATION

Database testing helps identify and mitigate security vulnerabilities, such as SQL injection attacks, which could compromise sensitive data.

Early detection and resolution of database issues during testing can significantly reduce the cost of fixing problems after deployment.

TYPES OF DATABASE TESTING:

There are three types of database testing. They include:

1. STRUCTURAL:

This type of database testing mainly focuses on the internal structure of the Data Base. Problems tested here include:

i) Data Type issues
ii) Constraint Testing (primary key, foreign key)

iii) Referential integrity checks

2. FUNCTIONAL:

This type of database testing is mainly used for checking whether the Data Base works according to the specified requirements. Problems tested here include:

i) CRUD [Create-Read-Update-Delete]
ii) Data manipulation through application interface

3. NON-FUNCTIONAL:

This type of database testing helps in measuring performance, scalability, reliability and security of the Data Base. Types include:

i) PERFORMANCE TEST- response time for each query
ii) LOAD TEST- handling large volume of data/ users
iii) SECURITY TEST- finds all possible loopholes/ weaknesses.
iv) STRESS TEST- checks whether DB works beyond normal workload
v) COMPATIBILITY TEST- aims to check the developed software application functions on many software and hardware platforms.

The Non-Functional database testing is mainly automated due to its complexity whereas the structural and functional testing can be done in both ways (automated and manual too).

TOOLS THAT ARE USED FOR DATABASE TESTING:

i) MANUAL:

1)MySQL Work Bench 2) Oracle SQL Developer 3) pG Admin

ii) Automated functions and structured DB Testing:

a) NoSQLUnit- Used for NoSQL databases.
b) pgTAP- SQL Unit Testing Framework
c) SQLTest: Automated testing of queries, procedures and result completion.

Tools for Automated Non-Functional Testing:

i) Apache JMeter: For load and performance testing
ii) LoadRunner- Load testing app
iii) OWASP-ZAP: Used for security testing

SELF HEALING:

Self-healing is the ability of automated tests to automatically adapt changes in the database schema/ data without manual intervention.

It involves using AI and ML techniques to identify, correct issues arising from Data Base updates.

They are needed in database testing as:

i) Renaming of column names
ii) Table structure change
iii) Data format change

Self-Healing improves efficiency by accelerating the error detection by automatically detecting and correcting errors.

HOW TO AUTOMATE DATA-BASE TESTING:

STEP1: Define objectives

STEP2: Create good test cases based on our objectives. The test cases include:

i) Data Integrity Test:
a) Primary Key Constraints
b) Foreign key Constraints
c) Unique Constraints

ii) Data Type Validations:
a) Range Checks
b) Format Checks

STEP3: Choose the best automation tool like Apache JMeter, Selenium etc.

STEP4: Setup the test environment.

STEP5: Integrate it with CI/CD.

STEP6: Execute the test.

STEP7: VALIDATE RESULTS AND MAINTAIN TEST SCRIPTS

STEP8: Monitor Performance

MY APPROACH TOWARDS SOLVING THIS PROBLEM:

MY APPROACH IS TO USE OLLAMA which is a large language model released by META AI on the month of FEB 2023.

It is an open-source model unlike GPT which is a proprietary model and is highly customizable, strong in code generation.

This will be run locally and then I will have a database having details of few players.

Then, I will be using Python and in Python I am using the unittest module which is used for automating the data validation logic and mysql.connector for connecting python with MySQL.

In this problem LLAMA will be used to heal the broken SQL queries and create a text file to store the error conditions.

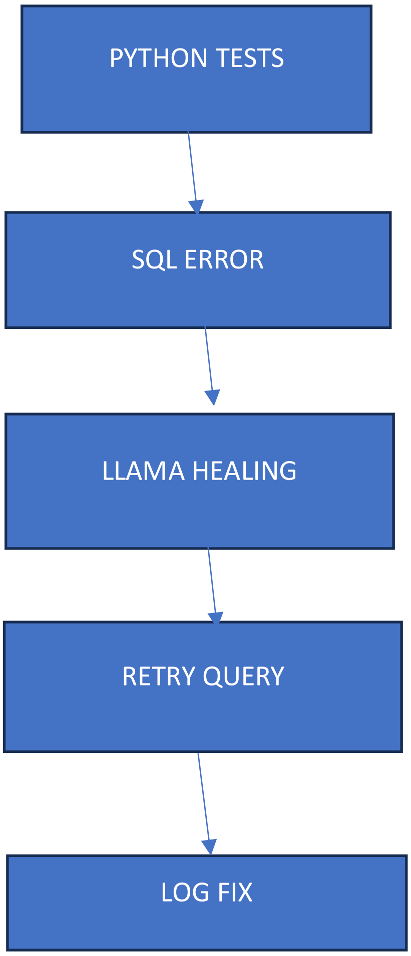


FIG1: ANALYSIS PATTERN OF SELF HEALING IN OUR DATABASE PROBLEM.

WE ALSO HAVE A FEW DATA VALIDATION RULES TO CHECK FOR WRONG TYPES, DUPLICATES.

STEPS INVOLVED IN MY PROCEDURE TO TEST SELF HEALING IN A DATABASE:

Step1: Software installations:

1. IDLE Python- Have the latest version installed (3.13.5). While installing just make sure that you add python.exe to the path which helps in proper installations of modules.

2.MySQL: MySQL is an open-source RDBMS which is fast, secure, reliable and easy to use when compared to the other database managements systems. Work with caution while installing it in your system as the installation is a long procedure.

3. After installing MySQL and Python install the modules which are necessary for completion of our project. Some of the modules which are used here for successful completion of project include:

i) mysql.connector : mysql.connector is a Python library that enables python programs to interact with MySQL databases. In our project one of the important modules is mysql.connector as our project is about self-healing in databases.

ii) Unittest: The unittest module is Python's built in unit testing framework. Along with this, it provides a structured, object-oriented approach to writing and running tests for Python codes.

iii) Datetime: We use the datetime module for mentioning the date at when the database testing takes place and the time at which the testing occurs. So, it provides us in having a log on having a note at the errors which occur in the database and tests the validity of the database.

iv) Json: Json stands for Java Script Object Notation. It is mainly used for transmitting data between a server and web application and also for storing structured data in the form of key- value pair.

v) re: The re module provides support for regular expressions. Regular expressions are powerful tools that enable tasks like searching, splitting, validating text-based patterns.

4. The tool which we use for achieving self-healing of a database along with Python and MySQL is Ollama. Ollama is a tool that is used for running and managing large language models locally on our computer. It simplifies the process of downloading, setting local LLM's and makes them accessible for research, code generation and automation of testing of DB. SO, this tool plays a very major role in our project.

5. Before we proceed into the testing part, let us firstly create a database which consist of details about the CSK Players who are from Australia. Create another database named original which is not used for testing and used only for viewing and knowing details about it.

6. Along with this we, have used a software called Memcached, which is a high performance, distributed memory object caching system. It acts as a short-term memory for applications. Here, the values are stored in the form of key-value pairs which makes it easy for storing and retrieving data. We use this for checking whether the datatype of a particular column has been changed when compared to the original database and if yes, we use self-healing for returning to the datatype of the memcached original database.

Then, here in this project to see the healed query and results of the tests conducted we have a notepad file named healing_log which logs them. For a better viewing we have created a UI for viewing them. For that, we have used the flask module. Flask is a microframework which is used for web development as it offers a minimal core with optional extensions allowing developers to choose and add functionality.

The flask module is built on top of two powerful libraries:

1. Jinja2
2. Werkzeug

FOLDER STRUCTURE

templates- This sub folder inside the folder sql_self_healing_project contains all the HTML frontend websites which are used for the UI. Inside it we have web-based files used for viewing the original, testing DB, viewing the datatypes of each column of the table present in the database, functions like viewing, updating, deleting and inserting values into the database and a web for viewing the test results that have been logged.

static- This sub-folder has the CSS file which is used for enhancing the web UI.

app.py- This python script serves as the backend for the UI which we have created. It helps in the creation of website by defining its functionality

cache_column_datatypes.py: This python script plays a major role in caching the datatypes of each column present in the database. Used for Memcaching the columns.

db_test_config.py: This python script has details regarding the host, user, password and the database name. It is used to connect the database with python for further testing's along with the mysql.connector module.

schema_healer.py: This python file plays a major role helping the UI application created to dynamically select the table and salary column if the name of the table and salary column changes.

data_validation_test.py; This python folder plays a major role in defining the test cases and perform the automation testing in the database. If any test fails we get an Assertion Error.

healing_test.py: This python script is like data_validation_test.py but here the addition is the healing part. If any of the test fails, the test is taken to LLAMA via Ollama which we have installed and for achieving this, we have another python file named healer.py

The healer.py python file has the prompt which must be sent to LLAMA via Ollama for working of self-healing.

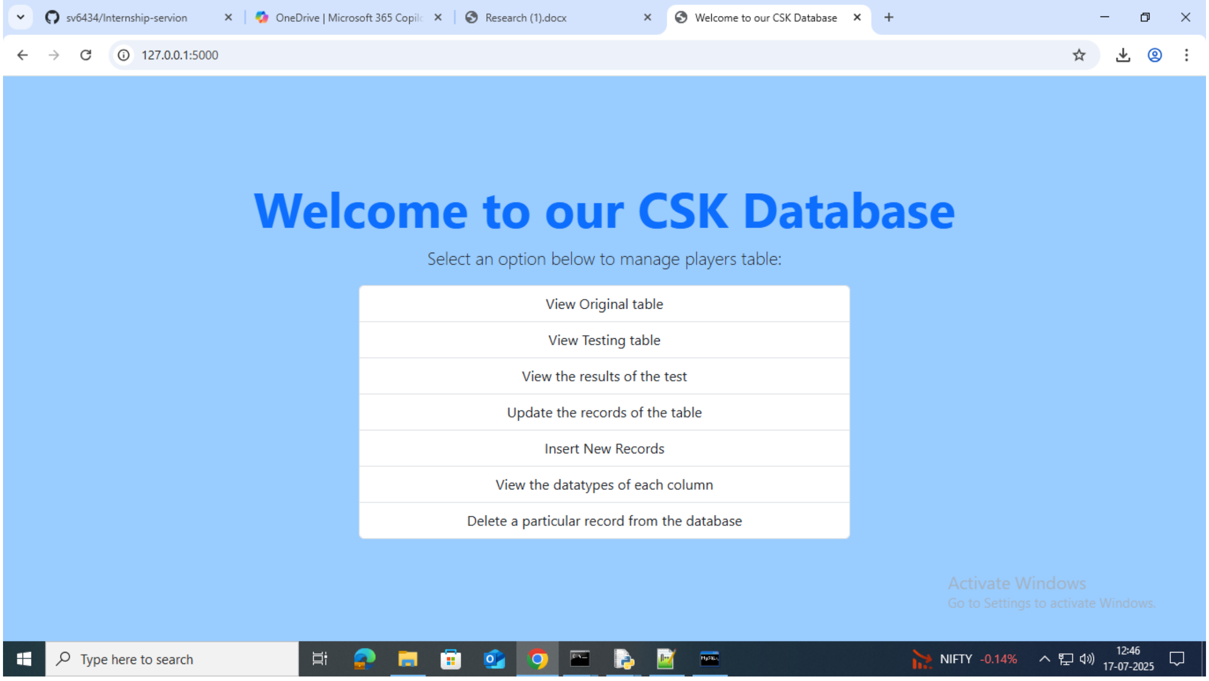
TEST CASES THAT WE WORK ON:

There are four test cases which we test in our self-healing project:

1. Salary being positive
2. Nationality to be ‘Australian’ unlike others as our sole purpose of the database is to have data of players from Australia.

3. Duplicates to be removed.
4. Ipl Team must be Chennai Super Kings unlike the other teams such as SRH, RCB etc.
5. If the column name changes it must get healed automatically and work accordingly
   These 4 test cases are checked and before running the validation tests, we must ensure that all the source codes required for the testing is kept in the same directory and at the same time make sure that all the modules are being installed for its successful completion of testing.
6. If the datatype of a particular column changes ex: int to float manually, the Ollama present must identify the change in the datatype due to caching of the columns at the datatype which is due to memcaching process done and get converted into the original datatype as per the original one.
7. Suppose the name of the table changes, the Ollama present for the self-healing must identify it and then proceed with the tests.

OUTPUT SCREENSHOT

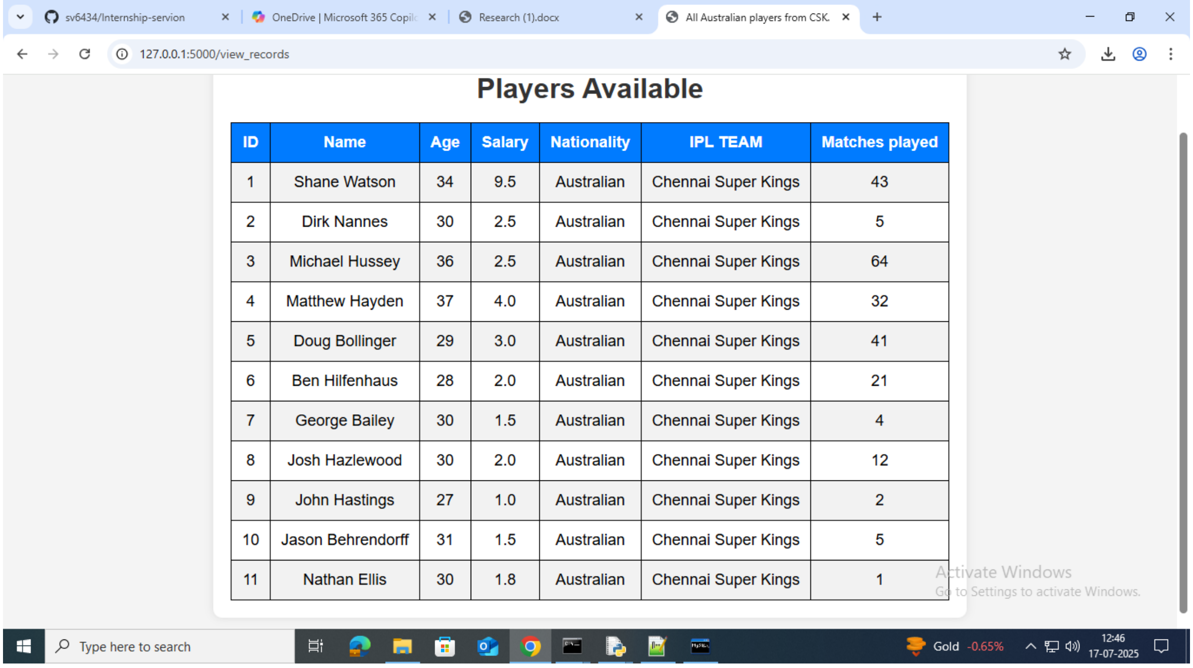


Welcome to our CSK Database

Select an option below to manage players table:

sv6434/Internship-servion
OneDrive | Microsoft 365 Copil
Research (1).docx
Welcome to our CSK Database
127.0.0.1:5000
View Original table
View Testing table
View the results of the test
Update the records of the table
Insert New Records
View the datatypes of each column
Delete a particular record from the database
Activate Windows
Go to Settings to activate Windows.
Type here to search
NIFTY -0.14%
12:46
17-07-2025

Fig1: The welcome page for our UI application

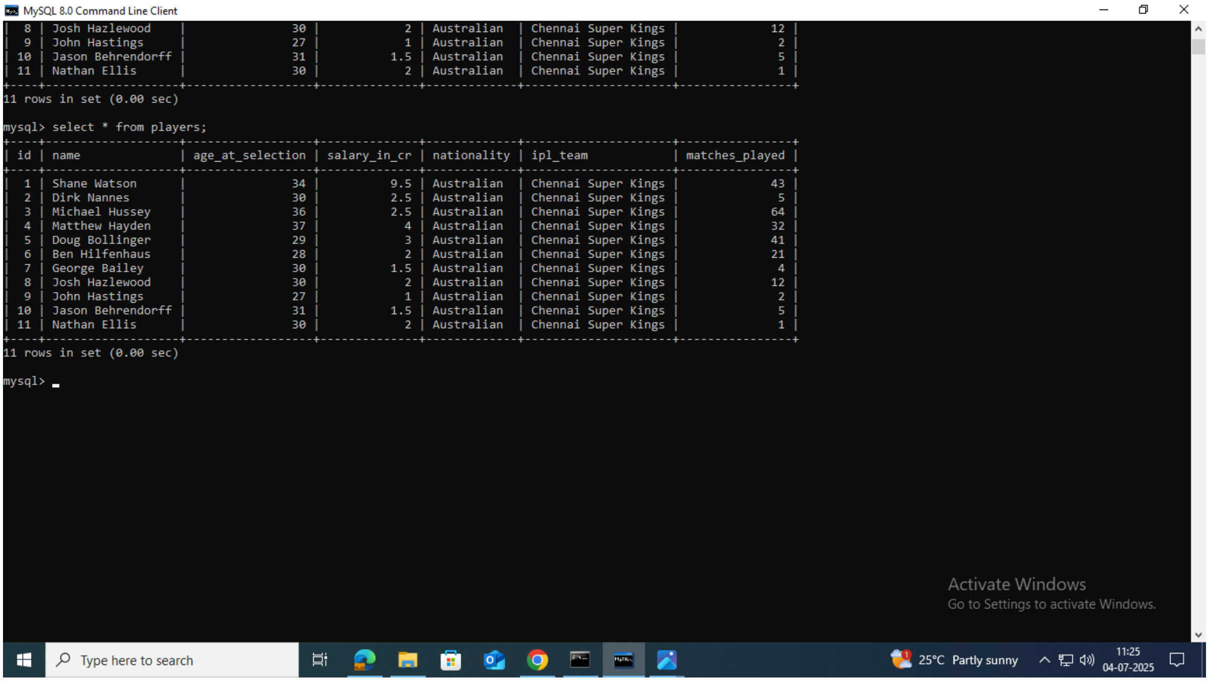


sv6434/Internship-servion
OneDrive | Microsoft 365 Copil
Research (1).docx
All Australian players from CSK.
127.0.0.1:5000/view_records
Activate Windows
Go to Settings to activate Windows.
Type here to search
Gold -0.65%
12:46
17-07-2025

Players Available

ID	Name	Age	Salary	Nationality	IPL TEAM	Matches played
1	Shane Watson	34	9.5	Australian	Chennai Super Kings	43
2	Dirk Nannes	30	2.5	Australian	Chennai Super Kings	5
3	Michael Hussey	36	2.5	Australian	Chennai Super Kings	64
4	Matthew Hayden	37	4.0	Australian	Chennai Super Kings	32
5	Doug Bollinger	29	3.0	Australian	Chennai Super Kings	41
6	Ben Hilfenhaus	28	2.0	Australian	Chennai Super Kings	21
7	George Bailey	30	1.5	Australian	Chennai Super Kings	4
8	Josh Hazlewood	30	2.0	Australian	Chennai Super Kings	12
9	John Hastings	27	1.0	Australian	Chennai Super Kings	2
10	Jason Behrendorff	31	1.5	Australian	Chennai Super Kings	5
11	Nathan Ellis	30	1.8	Australian	Chennai Super Kings	1

Fig2: The original database contents. Used only for read purpose and compare it with the testing database

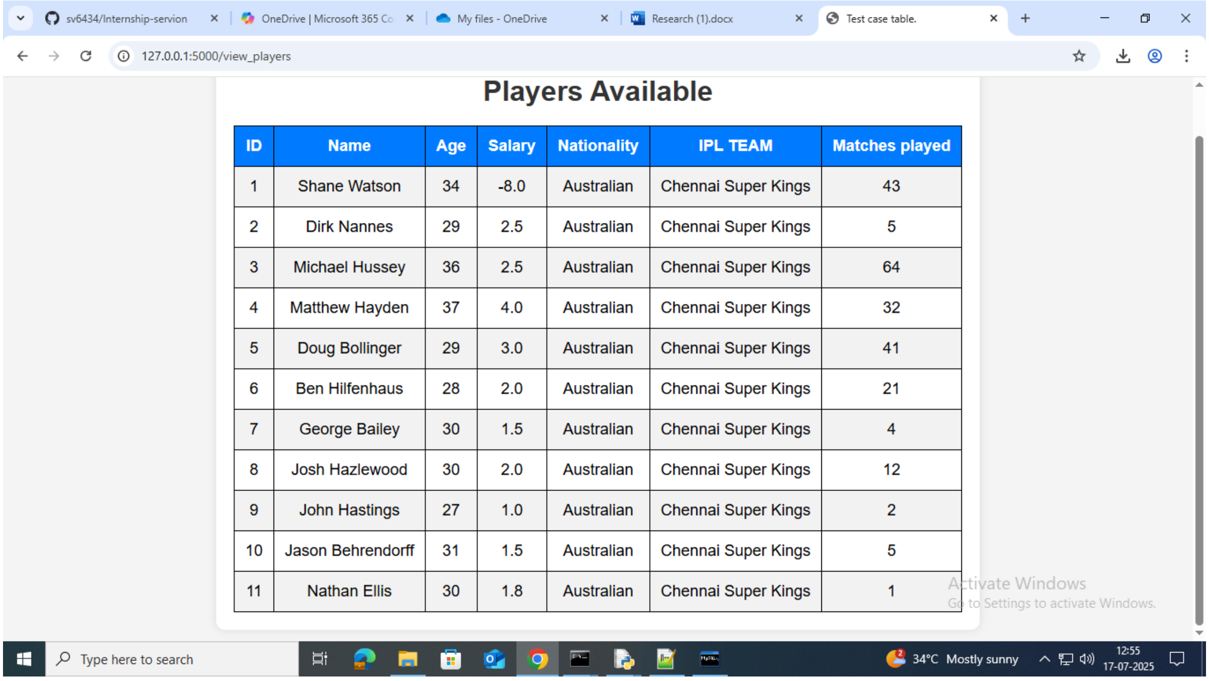


```
|  8 | Josh Hazlewood       |               30 |            2 | Australian  | Chennai Super Kings  |             12 |
|  9 | John Hastings        |               27 |            1 | Australian  | Chennai Super Kings  |              2 |
| 10 | Jason Behrendorff    |               31 |          1.5 | Australian  | Chennai Super Kings  |              5 |
| 11 | Nathan Ellis         |               30 |            2 | Australian  | Chennai Super Kings  |              1 |
+----+----------------------+------------------+--------------+-------------+----------------------+----------------+
11 rows in set (0.00 sec)

mysql> select * from players;
+----+----------------------+------------------+--------------+-------------+----------------------+----------------+
| id | name                 | age_at_selection | salary_in_cr | nationality | ipl_team             | matches_played |
+----+----------------------+------------------+--------------+-------------+----------------------+----------------+
|  1 | Shane Watson         |               34 |          9.5 | Australian  | Chennai Super Kings  |             43 |
|  2 | Dirk Nannes          |               30 |          2.5 | Australian  | Chennai Super Kings  |              5 |
|  3 | Michael Hussey       |               36 |          2.5 | Australian  | Chennai Super Kings  |             64 |
|  4 | Matthew Hayden       |               37 |            4 | Australian  | Chennai Super Kings  |             32 |
|  5 | Doug Bollinger       |               29 |            3 | Australian  | Chennai Super Kings  |             41 |
|  6 | Ben Hilfenhaus       |               28 |            2 | Australian  | Chennai Super Kings  |             21 |
|  7 | George Bailey        |               30 |          1.5 | Australian  | Chennai Super Kings  |              4 |
|  8 | Josh Hazlewood       |               30 |            2 | Australian  | Chennai Super Kings  |             12 |
|  9 | John Hastings        |               27 |            1 | Australian  | Chennai Super Kings  |              2 |
| 10 | Jason Behrendorff    |               31 |          1.5 | Australian  | Chennai Super Kings  |              5 |
| 11 | Nathan Ellis         |               30 |            2 | Australian  | Chennai Super Kings  |              1 |
+----+----------------------+------------------+--------------+-------------+----------------------+----------------+
11 rows in set (0.00 sec)

mysql> _
```

Fig3: The original database in MySQL.



Players Available

ID	Name	Age	Salary	Nationality	IPL TEAM	Matches played
1	Shane Watson	34	-8.0	Australian	Chennai Super Kings	43
2	Dirk Nannes	29	2.5	Australian	Chennai Super Kings	5
3	Michael Hussey	36	2.5	Australian	Chennai Super Kings	64
4	Matthew Hayden	37	4.0	Australian	Chennai Super Kings	32
5	Doug Bollinger	29	3.0	Australian	Chennai Super Kings	41
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7	George Bailey	30	1.5	Australian	Chennai Super Kings	4
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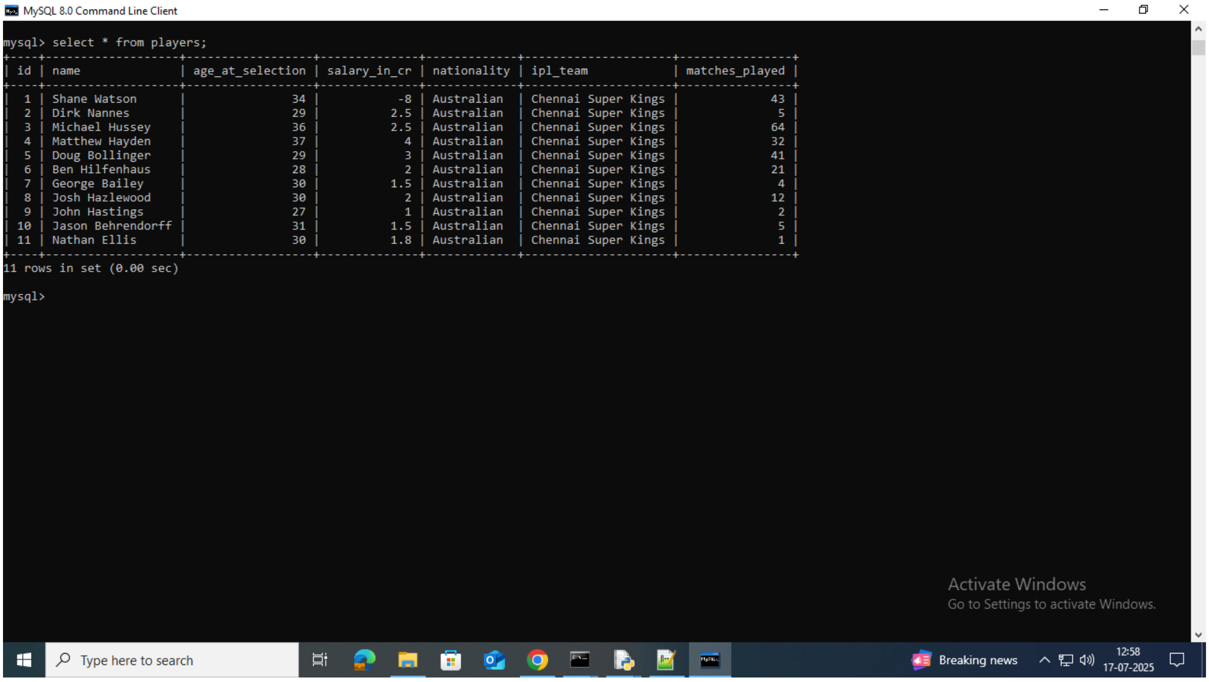
10	Jason Behrendorff	31	1.5	Australian	Chennai Super Kings	5
11	Nathan Ellis	30	1.8	Australian	Chennai Super Kings	1

Fig4: The UI part which shows that there is an invalid entry in the salary column.



```
mysql> select * from players;
+----+-------------------+------------------+--------------+-------------+---------------------+----------------+
| id | name              | age_at_selection | salary_in_cr | nationality | ipl_team            | matches_played |
+----+-------------------+------------------+--------------+-------------+---------------------+----------------+
|  1 | Shane Watson      |               34 |           -8 | Australian  | Chennai Super Kings |             43 |
|  2 | Dirk Nannes       |               29 |          2.5 | Australian  | Chennai Super Kings |              5 |
|  3 | Michael Hussey    |               36 |          2.5 | Australian  | Chennai Super Kings |             64 |
|  4 | Matthew Hayden    |               37 |            4 | Australian  | Chennai Super Kings |             32 |
|  5 | Doug Bollinger    |               29 |            3 | Australian  | Chennai Super Kings |             41 |
|  6 | Ben Hilfenhaus    |               28 |            2 | Australian  | Chennai Super Kings |             21 |
|  7 | George Bailey     |               30 |          1.5 | Australian  | Chennai Super Kings |              4 |
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|  9 | John Hastings     |               27 |            1 | Australian  | Chennai Super Kings |              2 |
| 10 | Jason Behrendorff |               31 |          1.5 | Australian  | Chennai Super Kings |              5 |
| 11 | Nathan Ellis      |               30 |          1.8 | Australian  | Chennai Super Kings |              1 |
+----+-------------------+------------------+--------------+-------------+---------------------+----------------+
11 rows in set (0.00 sec)

mysql>
```
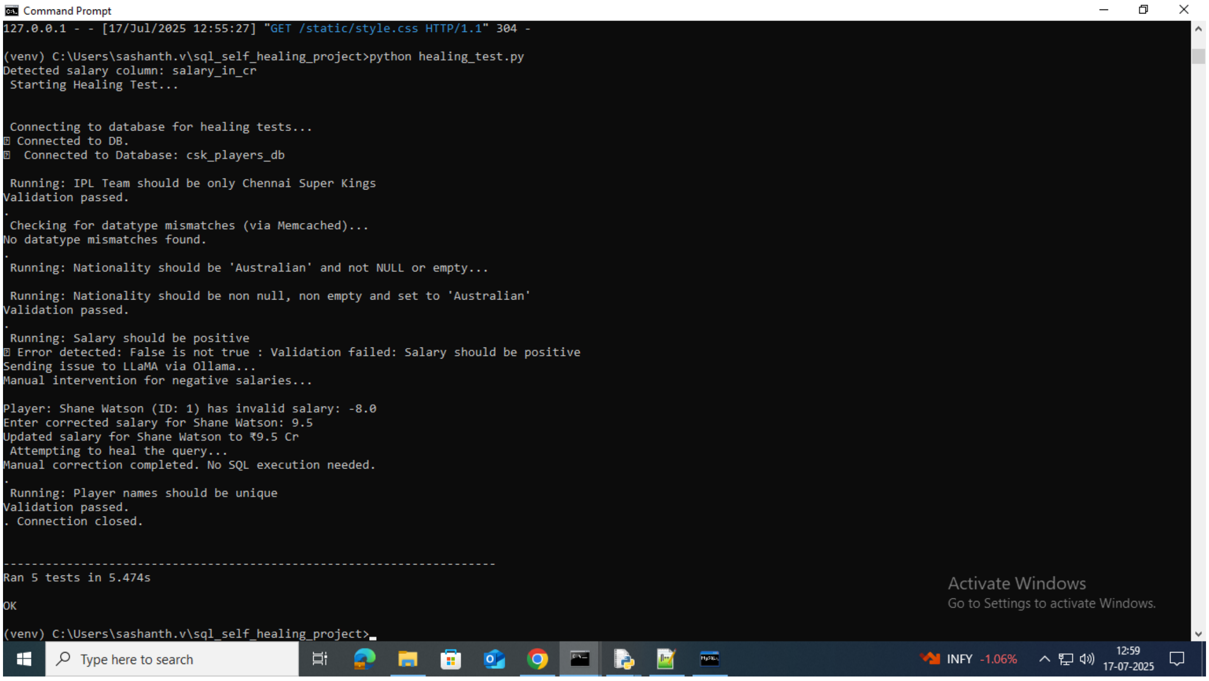
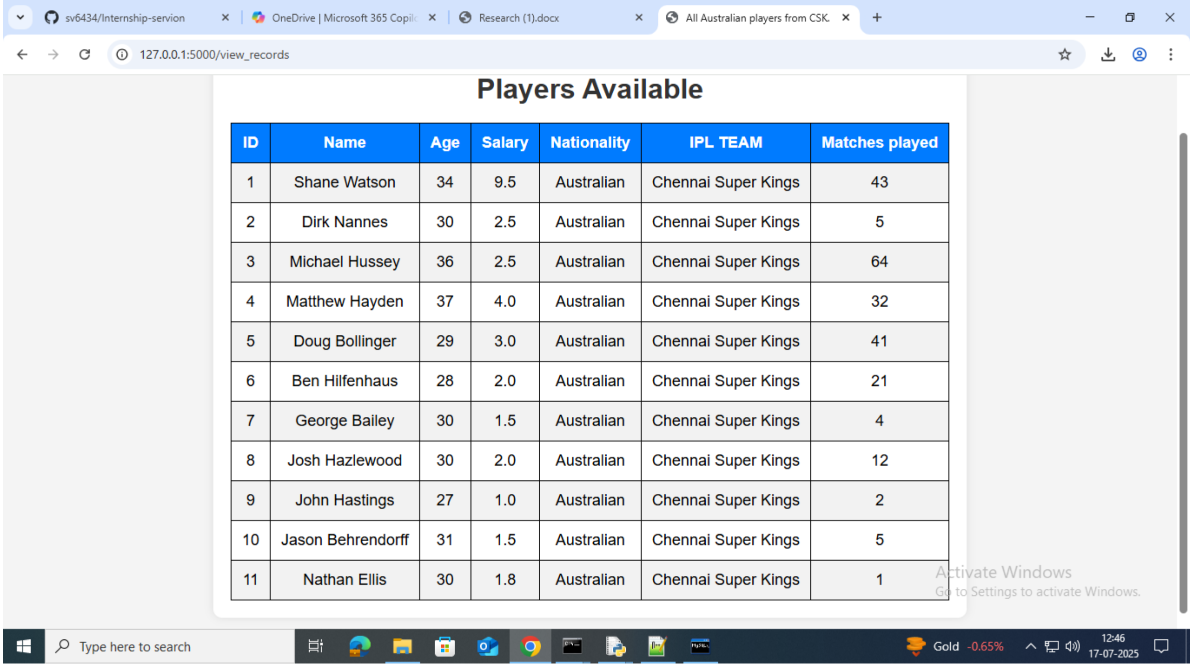

Fig5: The SQL viewer which shows that there is an invalid entry.



```
127.0.0.1 - - [17/Jul/2025 12:55:27] "GET /static/style.css HTTP/1.1" 304 -

(venv) C:\Users\sashanth.v\sql_self_healing_project>python healing_test.py
Detected salary column: salary_in_cr
 Starting Healing Test...


 Connecting to database for healing tests...
□ Connected to DB.
□  Connected to Database: csk_players_db

 Running: IPL Team should be only Chennai Super Kings
Validation passed.
.
 Checking for datatype mismatches (via Memcached)...
No datatype mismatches found.
.
 Running: Nationality should be 'Australian' and not NULL or empty...

 Running: Nationality should be non null, non empty and set to 'Australian'
Validation passed.
.
 Running: Salary should be positive
□ Error detected: False is not true : Validation failed: Salary should be positive
Sending issue to LLaMA via Ollama...
Manual intervention for negative salaries...

Player: Shane Watson (ID: 1) has invalid salary: -8.0
Enter corrected salary for Shane Watson: 9.5
Updated salary for Shane Watson to ₹9.5 Cr
 Attempting to heal the query...
Manual correction completed. No SQL execution needed.
.
 Running: Player names should be unique
Validation passed.
. Connection closed.


----------------------------------------------------------------------
Ran 5 tests in 5.474s

OK

(venv) C:\Users\sashanth.v\sql_self_healing_project>
```

Fig6: Running the self healing test in the cmd.


sv6434/Internship-servion
OneDrive | Microsoft 365 Copilo
Research (1).docx
All Australian players from CSK
127.0.0.1:5000/view_records
Type here to search
Gold -0.65%
12:46
17-07-2025
Activate Windows
Go to Settings to activate Windows.

Players Available

ID	Name	Age	Salary	Nationality	IPL TEAM	Matches played
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4	Matthew Hayden	37	4.0	Australian	Chennai Super Kings	32
5	Doug Bollinger	29	3.0	Australian	Chennai Super Kings	41
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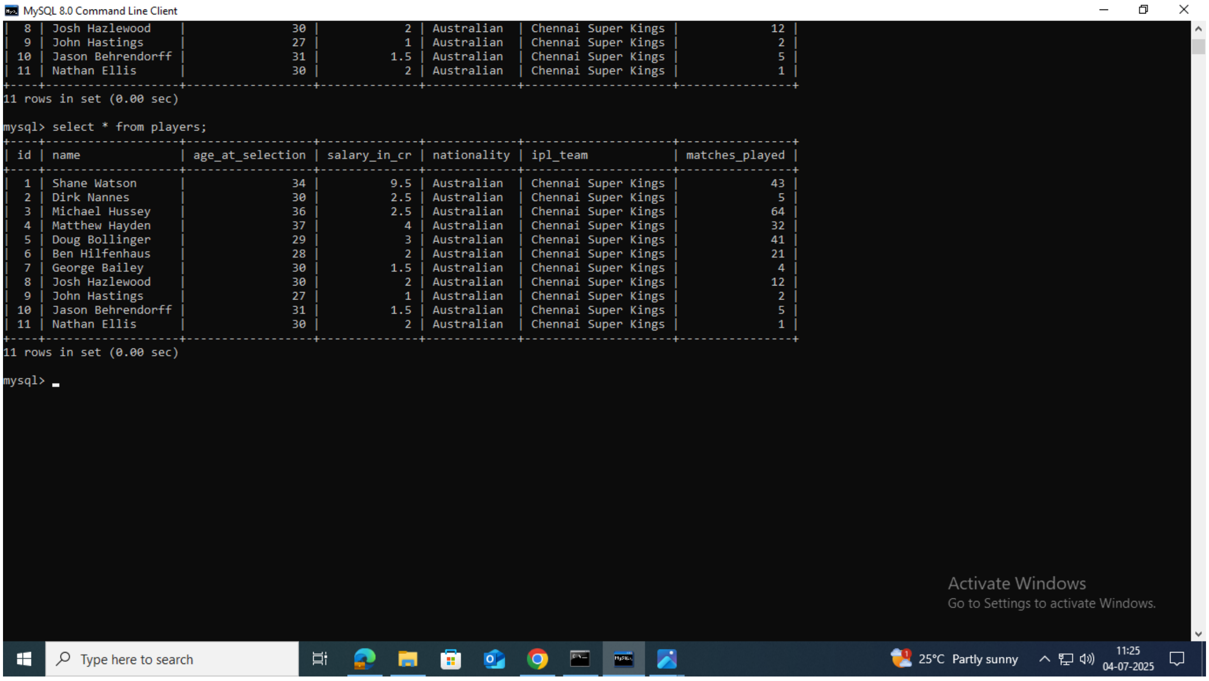
9	John Hastings	27	1.0	Australian	Chennai Super Kings	2
10	Jason Behrendorff	31	1.5	Australian	Chennai Super Kings	5
11	Nathan Ellis	30	1.8	Australian	Chennai Super Kings	1

Fig7: The self healed DB.



```
|  8 | Josh Hazlewood    |               30 |            2 | Australian  | Chennai Super Kings |             12 |
|  9 | John Hastings     |               27 |            1 | Australian  | Chennai Super Kings |              2 |
| 10 | Jason Behrendorff |               31 |          1.5 | Australian  | Chennai Super Kings |              5 |
| 11 | Nathan Ellis      |               30 |            2 | Australian  | Chennai Super Kings |              1 |
+----+-------------------+------------------+--------------+-------------+---------------------+----------------+
11 rows in set (0.00 sec)

mysql> select * from players;
+----+-------------------+------------------+--------------+-------------+---------------------+----------------+
| id | name              | age_at_selection | salary_in_cr | nationality | ipl_team            | matches_played |
+----+-------------------+------------------+--------------+-------------+---------------------+----------------+
|  1 | Shane Watson      |               34 |          9.5 | Australian  | Chennai Super Kings |             43 |
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|  6 | Ben Hilfenhaus    |               28 |            2 | Australian  | Chennai Super Kings |             21 |
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| 10 | Jason Behrendorff |               31 |          1.5 | Australian  | Chennai Super Kings |              5 |
| 11 | Nathan Ellis      |               30 |            2 | Australian  | Chennai Super Kings |              1 |
+----+-------------------+------------------+--------------+-------------+---------------------+----------------+
11 rows in set (0.00 sec)

mysql> _
```
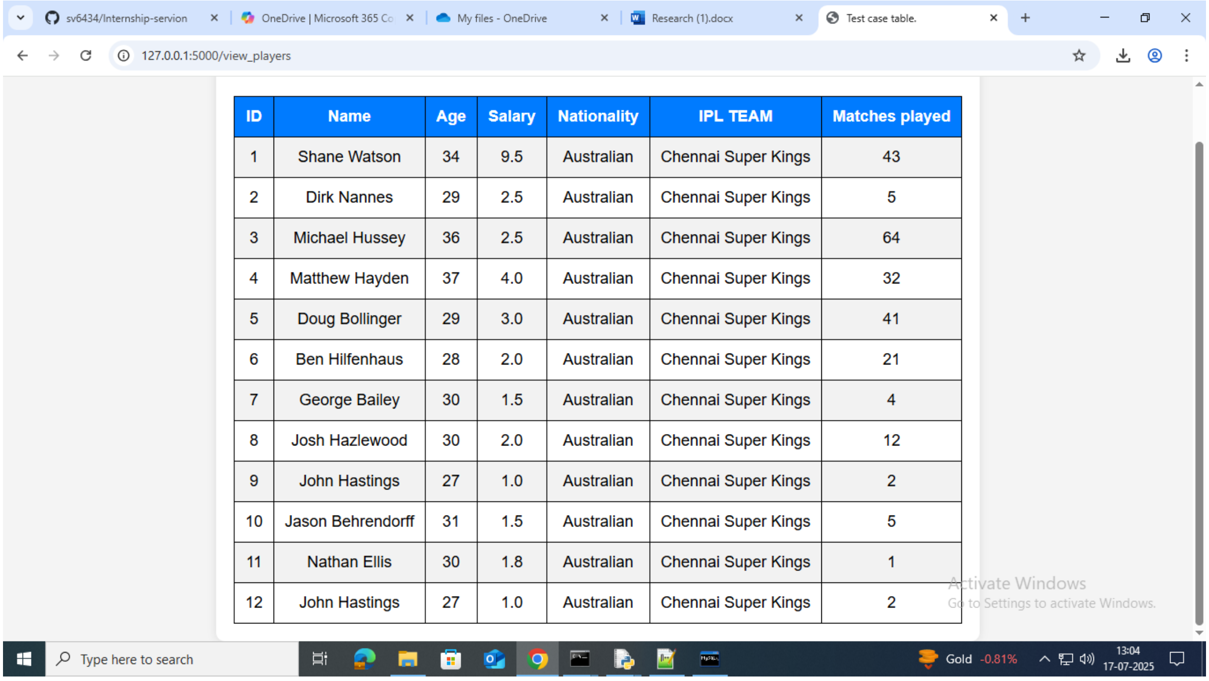

Fig8:Viewing it in MySQL.


sv6434/Internship-servion
OneDrive | Microsoft 365 Co
My files - OneDrive
Research (1).docx
Test case table.
127.0.0.1:5000/view_players
Activate Windows
Go to Settings to activate Windows.
Type here to search
Gold -0.81%
13:04
17-07-2025

ID	Name	Age	Salary	Nationality	IPL TEAM	Matches played
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3	Michael Hussey	36	2.5	Australian	Chennai Super Kings	64
4	Matthew Hayden	37	4.0	Australian	Chennai Super Kings	32
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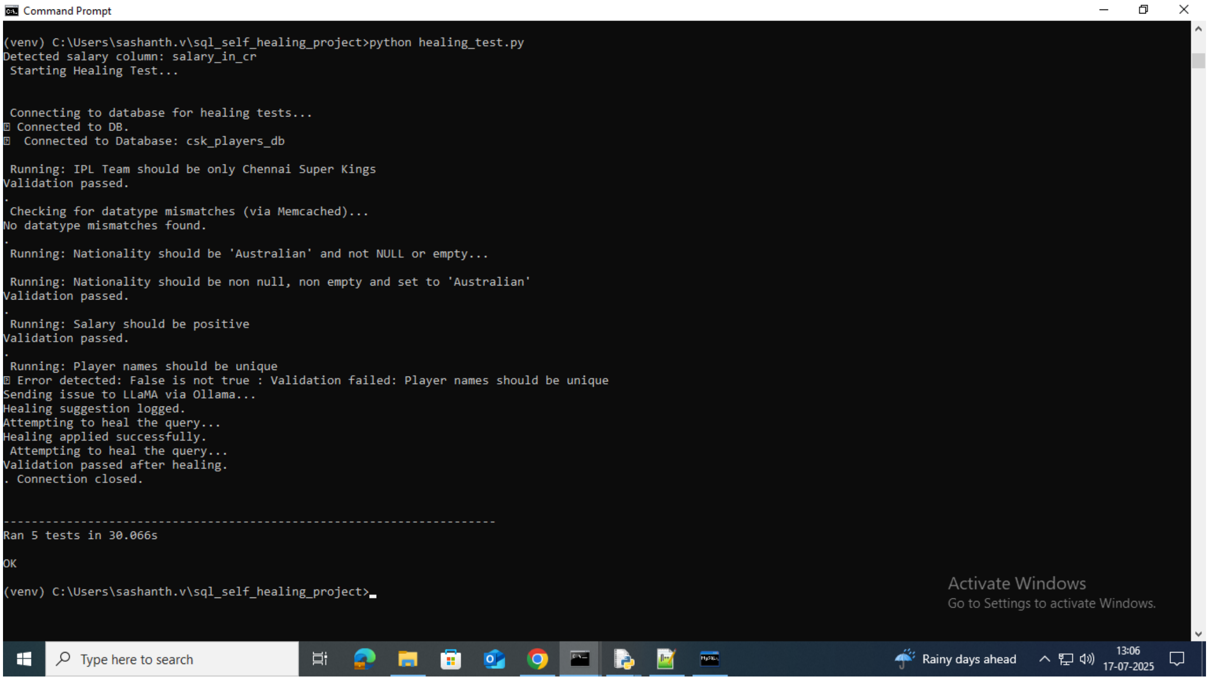
10	Jason Behrendorff	31	1.5	Australian	Chennai Super Kings	5
11	Nathan Ellis	30	1.8	Australian	Chennai Super Kings	1
12	John Hastings	27	1.0	Australian	Chennai Super Kings	2

Fig9: Seeing the database which has a duplicate entry in the 12th row.



```
(venv) C:\Users\sashanth.v\sql_self_healing_project>python healing_test.py
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 Connecting to database for healing tests...
□ Connected to DB.
□  Connected to Database: csk_players_db

 Running: IPL Team should be only Chennai Super Kings
Validation passed.
.
 Checking for datatype mismatches (via Memcached)...
No datatype mismatches found.

 Running: Nationality should be 'Australian' and not NULL or empty...

 Running: Nationality should be non null, non empty and set to 'Australian'
Validation passed.
.
 Running: Salary should be positive
Validation passed.
.
 Running: Player names should be unique
□ Error detected: False is not true : Validation failed: Player names should be unique
Sending issue to LLaMA via Ollama...
Healing suggestion logged.
Attempting to heal the query...
Healing applied successfully.
 Attempting to heal the query...
Validation passed after healing.
. Connection closed.


----------------------------------------------------------------------
Ran 5 tests in 30.066s

OK

(venv) C:\Users\sashanth.v\sql_self_healing_project>
```
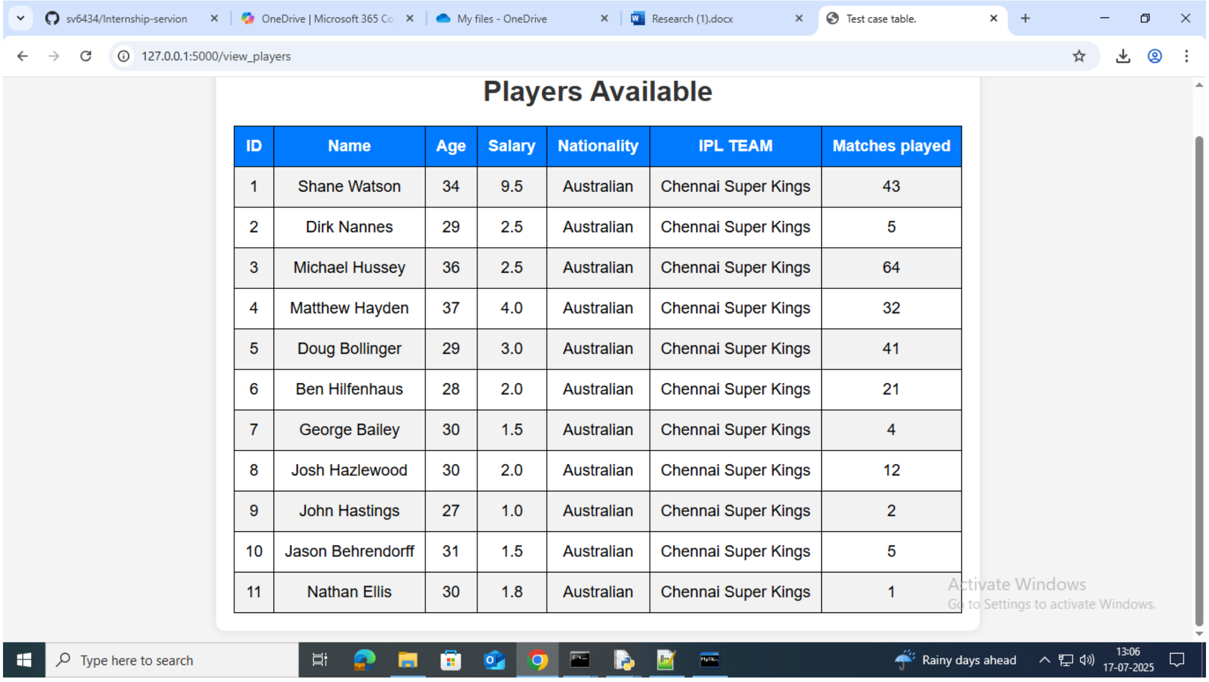

Fig10: Running the test in cmd.



Players Available

ID	Name	Age	Salary	Nationality	IPL TEAM	Matches played
1	Shane Watson	34	9.5	Australian	Chennai Super Kings	43
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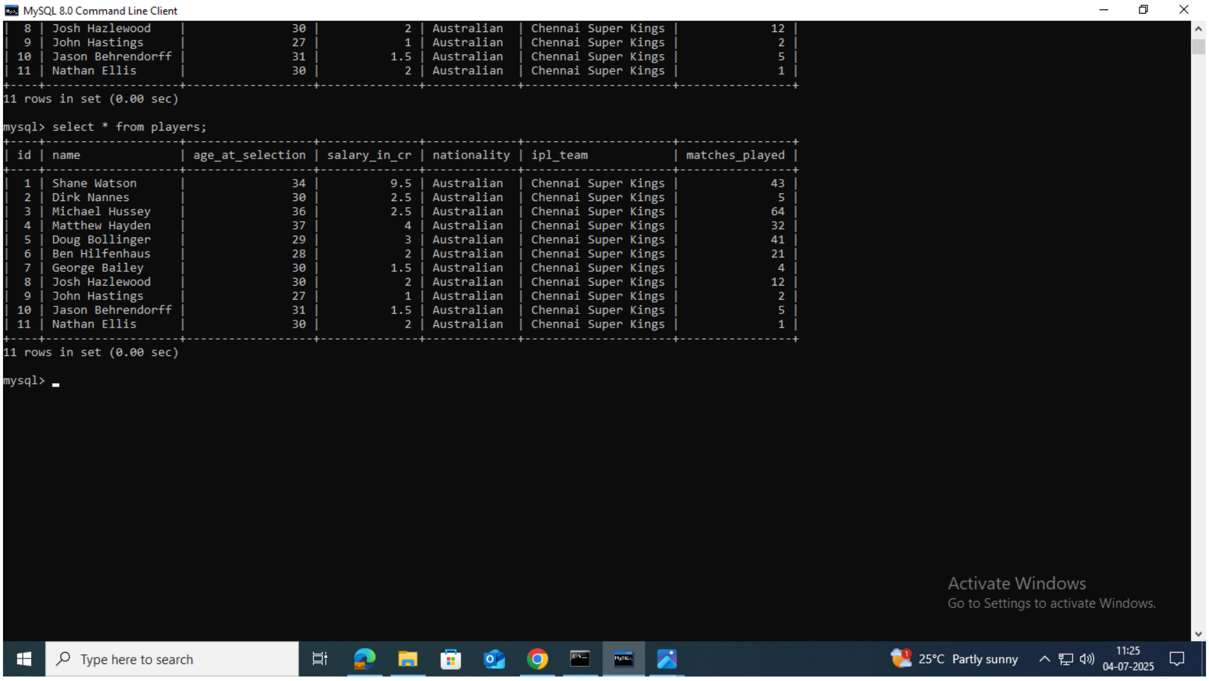
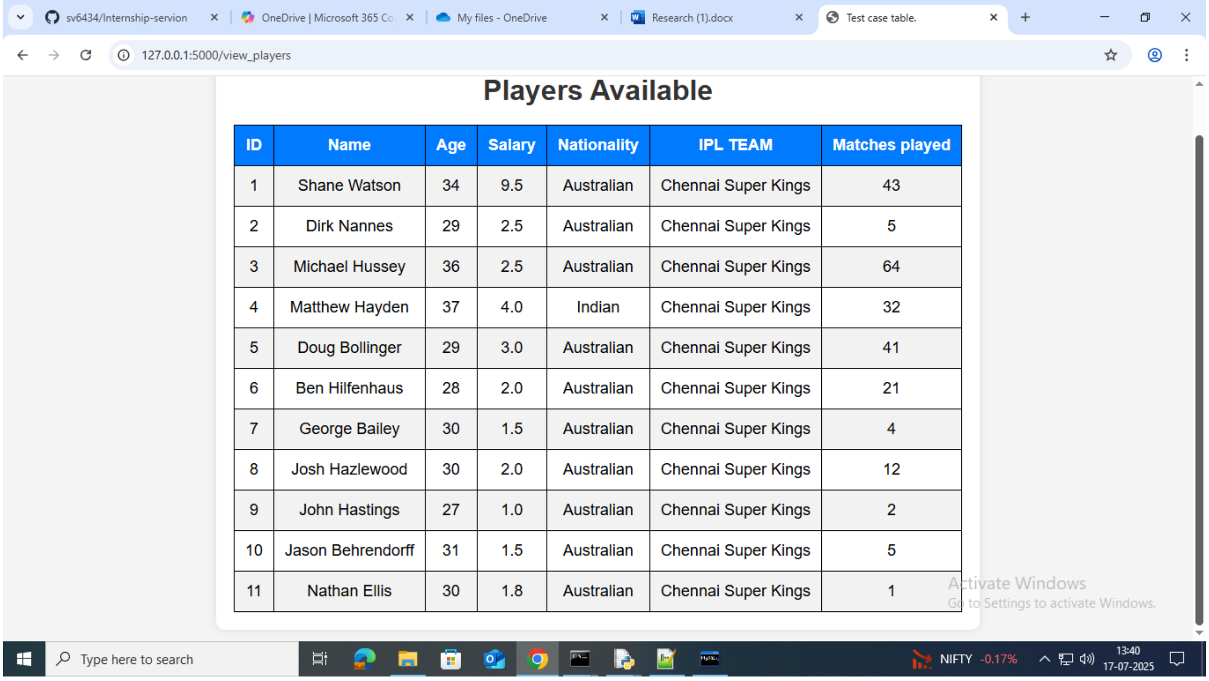
5	Doug Bollinger	29	3.0	Australian	Chennai Super Kings	41
6	Ben Hilfenhaus	28	2.0	Australian	Chennai Super Kings	21
7	George Bailey	30	1.5	Australian	Chennai Super Kings	4
8	Josh Hazlewood	30	2.0	Australian	Chennai Super Kings	12
9	John Hastings	27	1.0	Australian	Chennai Super Kings	2
10	Jason Behrendorff	31	1.5	Australian	Chennai Super Kings	5
11	Nathan Ellis	30	1.8	Australian	Chennai Super Kings	1

Fig11; Viewing the self healed DB.



```
|  8 | Josh Hazlewood    |               30 |            2 | Australian  | Chennai Super Kings |             12 |
|  9 | John Hastings     |               27 |            1 | Australian  | Chennai Super Kings |              2 |
| 10 | Jason Behrendorff |               31 |          1.5 | Australian  | Chennai Super Kings |              5 |
| 11 | Nathan Ellis      |               30 |            2 | Australian  | Chennai Super Kings |              1 |
+----+-------------------+------------------+--------------+-------------+---------------------+----------------+
11 rows in set (0.00 sec)

mysql> select * from players;
+----+-------------------+------------------+--------------+-------------+---------------------+----------------+
| id | name              | age_at_selection | salary_in_cr | nationality | ipl_team            | matches_played |
+----+-------------------+------------------+--------------+-------------+---------------------+----------------+
|  1 | Shane Watson      |               34 |          9.5 | Australian  | Chennai Super Kings |             43 |
|  2 | Dirk Nannes       |               30 |          2.5 | Australian  | Chennai Super Kings |              5 |
|  3 | Michael Hussey    |               36 |          2.5 | Australian  | Chennai Super Kings |             64 |
|  4 | Matthew Hayden    |               37 |            4 | Australian  | Chennai Super Kings |             32 |
|  5 | Doug Bollinger    |               29 |            3 | Australian  | Chennai Super Kings |             41 |
|  6 | Ben Hilfenhaus    |               28 |            2 | Australian  | Chennai Super Kings |             21 |
|  7 | George Bailey     |               30 |          1.5 | Australian  | Chennai Super Kings |              4 |
|  8 | Josh Hazlewood    |               30 |            2 | Australian  | Chennai Super Kings |             12 |
|  9 | John Hastings     |               27 |            1 | Australian  | Chennai Super Kings |              2 |
| 10 | Jason Behrendorff |               31 |          1.5 | Australian  | Chennai Super Kings |              5 |
| 11 | Nathan Ellis      |               30 |            2 | Australian  | Chennai Super Kings |              1 |
+----+-------------------+------------------+--------------+-------------+---------------------+----------------+
11 rows in set (0.00 sec)

mysql> _
```

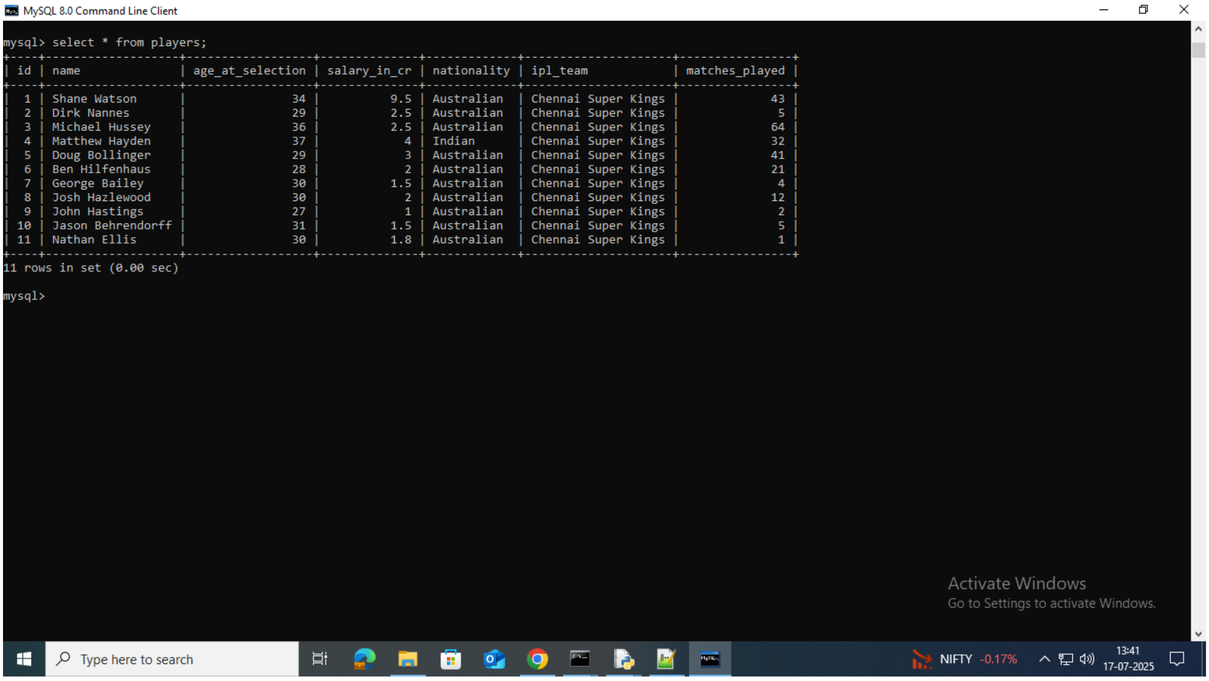
Fig12: Viewing in MySQL.


sv6434/Internship-servion
OneDrive | Microsoft 365 Co
My files - OneDrive
Research (1).docx
Test case table.
127.0.0.1:5000/view_players
Activate Windows
Go to Settings to activate Windows.
Type here to search
NIFTY -0.17%
13:40
17-07-2025

Players Available

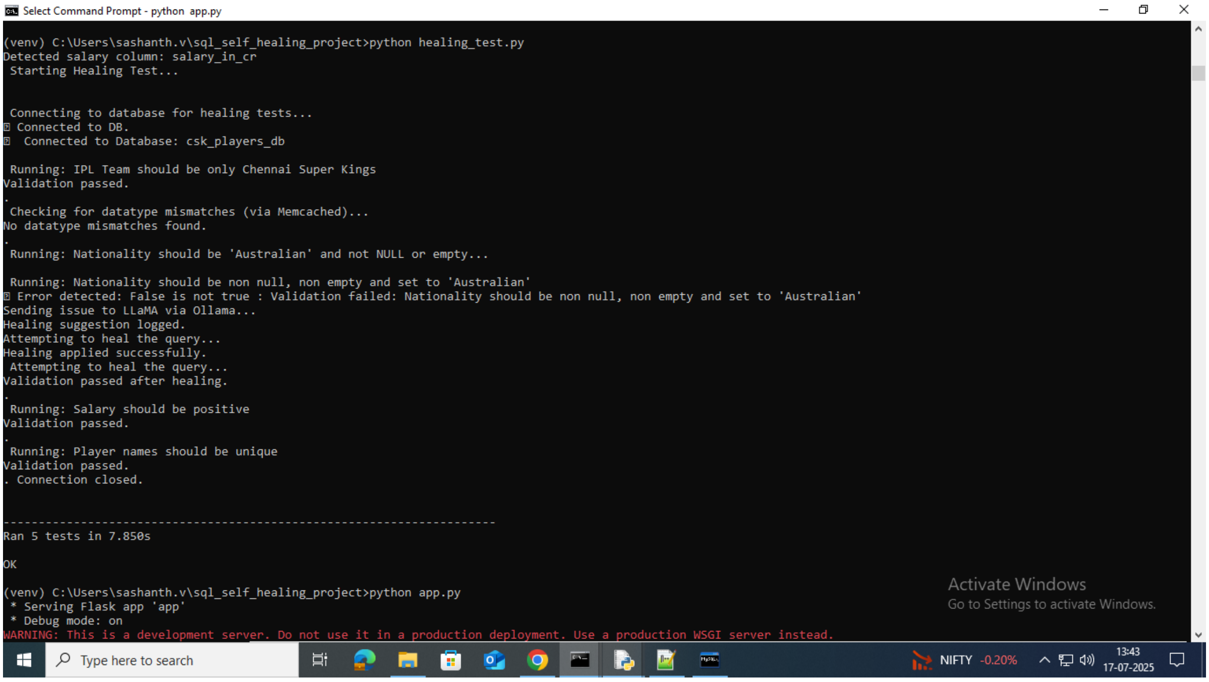
ID	Name	Age	Salary	Nationality	IPL TEAM	Matches played
1	Shane Watson	34	9.5	Australian	Chennai Super Kings	43
2	Dirk Nannes	29	2.5	Australian	Chennai Super Kings	5
3	Michael Hussey	36	2.5	Australian	Chennai Super Kings	64
4	Matthew Hayden	37	4.0	Indian	Chennai Super Kings	32
5	Doug Bollinger	29	3.0	Australian	Chennai Super Kings	41
6	Ben Hilfenhaus	28	2.0	Australian	Chennai Super Kings	21
7	George Bailey	30	1.5	Australian	Chennai Super Kings	4
8	Josh Hazlewood	30	2.0	Australian	Chennai Super Kings	12
9	John Hastings	27	1.0	Australian	Chennai Super Kings	2
10	Jason Behrendorff	31	1.5	Australian	Chennai Super Kings	5
11	Nathan Ellis	30	1.8	Australian	Chennai Super Kings	1

Fig13: Viewing the DB which has an invalid entry in the nationality column for person with id=4.


MySQL 8.0 Command Line Client
Activate Windows
Go to Settings to activate Windows.
Type here to search
NIFTY -0.17%
13:41
17-07-2025

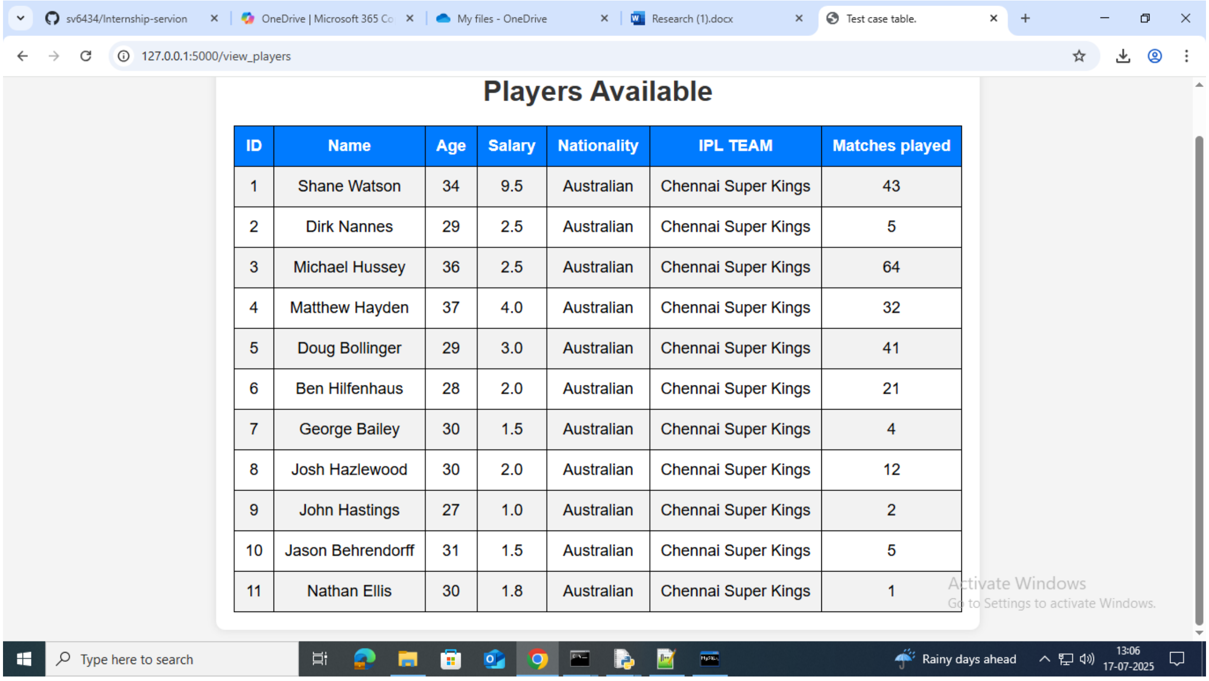
```
mysql> select * from players;
+----+-------------------+------------------+-------------+-------------+---------------------+----------------+
| id | name              | age_at_selection | salary_in_cr | nationality | ipl_team            | matches_played |
+----+-------------------+------------------+-------------+-------------+---------------------+----------------+
|  1 | Shane Watson      |               34 |         9.5 | Australian  | Chennai Super Kings |             43 |
|  2 | Dirk Nannes       |               29 |         2.5 | Australian  | Chennai Super Kings |              5 |
|  3 | Michael Hussey    |               36 |         2.5 | Australian  | Chennai Super Kings |             64 |
|  4 | Matthew Hayden    |               37 |           4 | Indian      | Chennai Super Kings |             32 |
|  5 | Doug Bollinger    |               29 |           3 | Australian  | Chennai Super Kings |             41 |
|  6 | Ben Hilfenhaus    |               28 |           2 | Australian  | Chennai Super Kings |             21 |
|  7 | George Bailey     |               30 |         1.5 | Australian  | Chennai Super Kings |              4 |
|  8 | Josh Hazlewood    |               30 |           2 | Australian  | Chennai Super Kings |             12 |
|  9 | John Hastings     |               27 |           1 | Australian  | Chennai Super Kings |              2 |
| 10 | Jason Behrendorff |               31 |         1.5 | Australian  | Chennai Super Kings |              5 |
| 11 | Nathan Ellis      |               30 |         1.8 | Australian  | Chennai Super Kings |              1 |
+----+-------------------+------------------+-------------+-------------+---------------------+----------------+
11 rows in set (0.00 sec)

mysql>
```

Fig14: The SQL viewer which shows that there is an invalid entry in the nationality column.


Select Command Prompt - python app.py
Activate Windows
Go to Settings to activate Windows.
Type here to search
NIFTY -0.20%
13:43
17-07-2025

```
(venv) C:\Users\sashanth.v\sql_self_healing_project>python healing_test.py
Detected salary column: salary_in_cr
 Starting Healing Test...


 Connecting to database for healing tests...
□ Connected to DB.
□  Connected to Database: csk_players_db

 Running: IPL Team should be only Chennai Super Kings
Validation passed.
.
 Checking for datatype mismatches (via Memcached)...
No datatype mismatches found.
.
 Running: Nationality should be 'Australian' and not NULL or empty...

 Running: Nationality should be non null, non empty and set to 'Australian'
□ Error detected: False is not true : Validation failed: Nationality should be non null, non empty and set to 'Australian'
Sending issue to LLaMA via Ollama...
Healing suggestion logged.
Attempting to heal the query...
Healing applied successfully.
 Attempting to heal the query...
Validation passed after healing.
.
 Running: Salary should be positive
Validation passed.
.
 Running: Player names should be unique
Validation passed.
. Connection closed.


----------------------------------------------------------------------
Ran 5 tests in 7.850s

OK

(venv) C:\Users\sashanth.v\sql_self_healing_project>python app.py
 * Serving Flask app 'app'
 * Debug mode: on
WARNING: This is a development server. Do not use it in a production deployment. Use a production WSGI server instead.
```

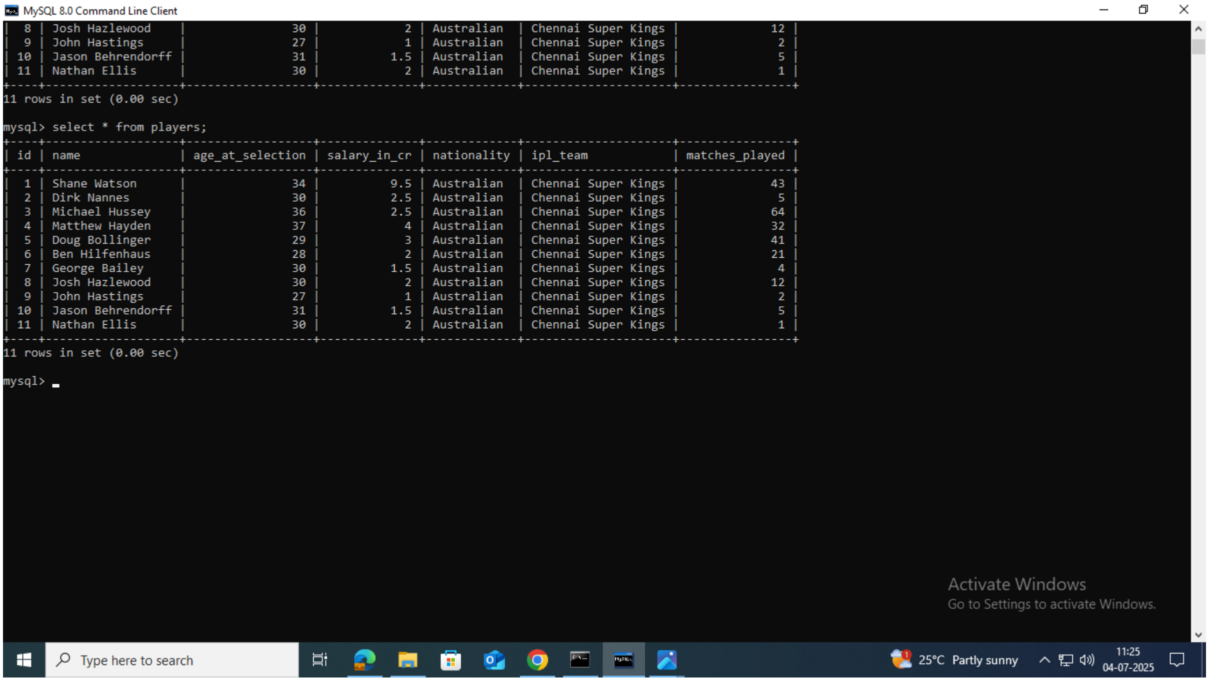
Fig15: Running the test via cmd



Players Available

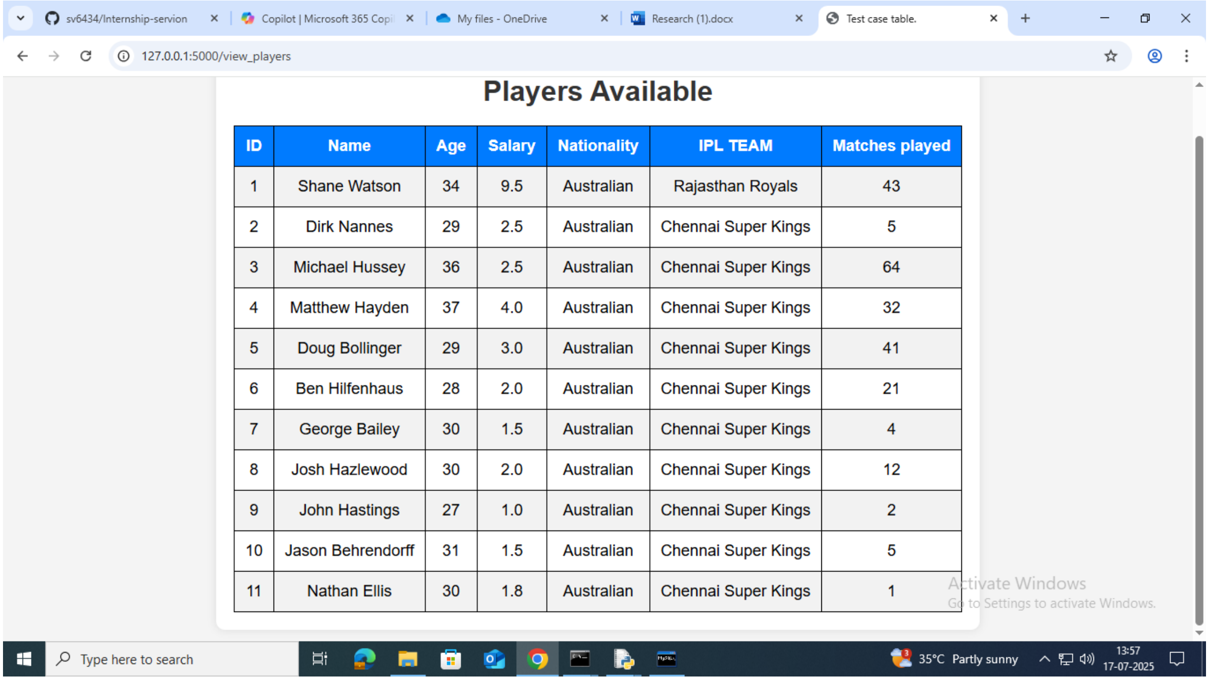
ID	Name	Age	Salary	Nationality	IPL TEAM	Matches played
1	Shane Watson	34	9.5	Australian	Chennai Super Kings	43
2	Dirk Nannes	29	2.5	Australian	Chennai Super Kings	5
3	Michael Hussey	36	2.5	Australian	Chennai Super Kings	64
4	Matthew Hayden	37	4.0	Australian	Chennai Super Kings	32
5	Doug Bollinger	29	3.0	Australian	Chennai Super Kings	41
6	Ben Hilfenhaus	28	2.0	Australian	Chennai Super Kings	21
7	George Bailey	30	1.5	Australian	Chennai Super Kings	4
8	Josh Hazlewood	30	2.0	Australian	Chennai Super Kings	12
9	John Hastings	27	1.0	Australian	Chennai Super Kings	2
10	Jason Behrendorff	31	1.5	Australian	Chennai Super Kings	5
11	Nathan Ellis	30	1.8	Australian	Chennai Super Kings	1

Fig16: The self-healed DB.



```
|  8 | Josh Hazlewood    |               30 |            2 | Australian  | Chennai Super Kings |             12 |
|  9 | John Hastings     |               27 |            1 | Australian  | Chennai Super Kings |              2 |
| 10 | Jason Behrendorff |               31 |          1.5 | Australian  | Chennai Super Kings |              5 |
| 11 | Nathan Ellis      |               30 |            2 | Australian  | Chennai Super Kings |              1 |
+----+-------------------+------------------+--------------+-------------+---------------------+----------------+
11 rows in set (0.00 sec)

mysql> select * from players;
+----+-------------------+------------------+--------------+-------------+---------------------+----------------+
| id | name              | age_at_selection | salary_in_cr | nationality | ipl_team            | matches_played |
+----+-------------------+------------------+--------------+-------------+---------------------+----------------+
|  1 | Shane Watson      |               34 |          9.5 | Australian  | Chennai Super Kings |             43 |
|  2 | Dirk Nannes       |               30 |          2.5 | Australian  | Chennai Super Kings |              5 |
|  3 | Michael Hussey    |               36 |          2.5 | Australian  | Chennai Super Kings |             64 |
|  4 | Matthew Hayden    |               37 |            4 | Australian  | Chennai Super Kings |             32 |
|  5 | Doug Bollinger    |               29 |            3 | Australian  | Chennai Super Kings |             41 |
|  6 | Ben Hilfenhaus    |               28 |            2 | Australian  | Chennai Super Kings |             21 |
|  7 | George Bailey     |               30 |          1.5 | Australian  | Chennai Super Kings |              4 |
|  8 | Josh Hazlewood    |               30 |            2 | Australian  | Chennai Super Kings |             12 |
|  9 | John Hastings     |               27 |            1 | Australian  | Chennai Super Kings |              2 |
| 10 | Jason Behrendorff |               31 |          1.5 | Australian  | Chennai Super Kings |              5 |
| 11 | Nathan Ellis      |               30 |            2 | Australian  | Chennai Super Kings |              1 |
+----+-------------------+------------------+--------------+-------------+---------------------+----------------+
11 rows in set (0.00 sec)

mysql> _
```

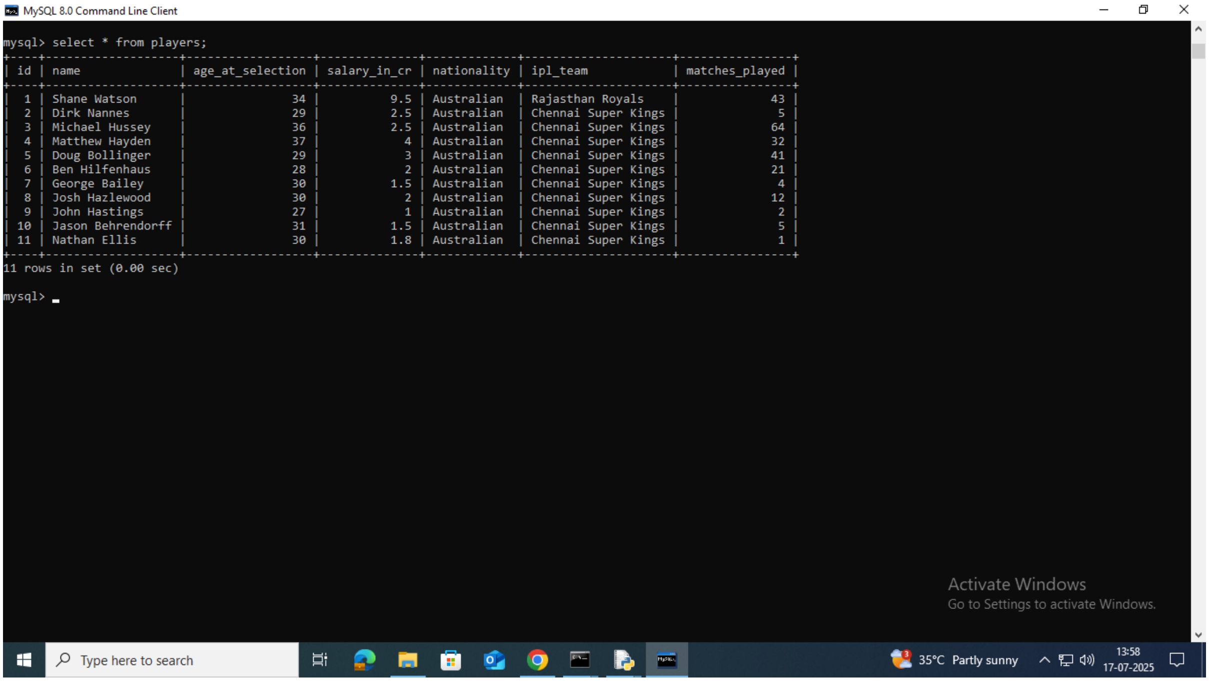
Fig17: Viewing it via MySQL.



Players Available

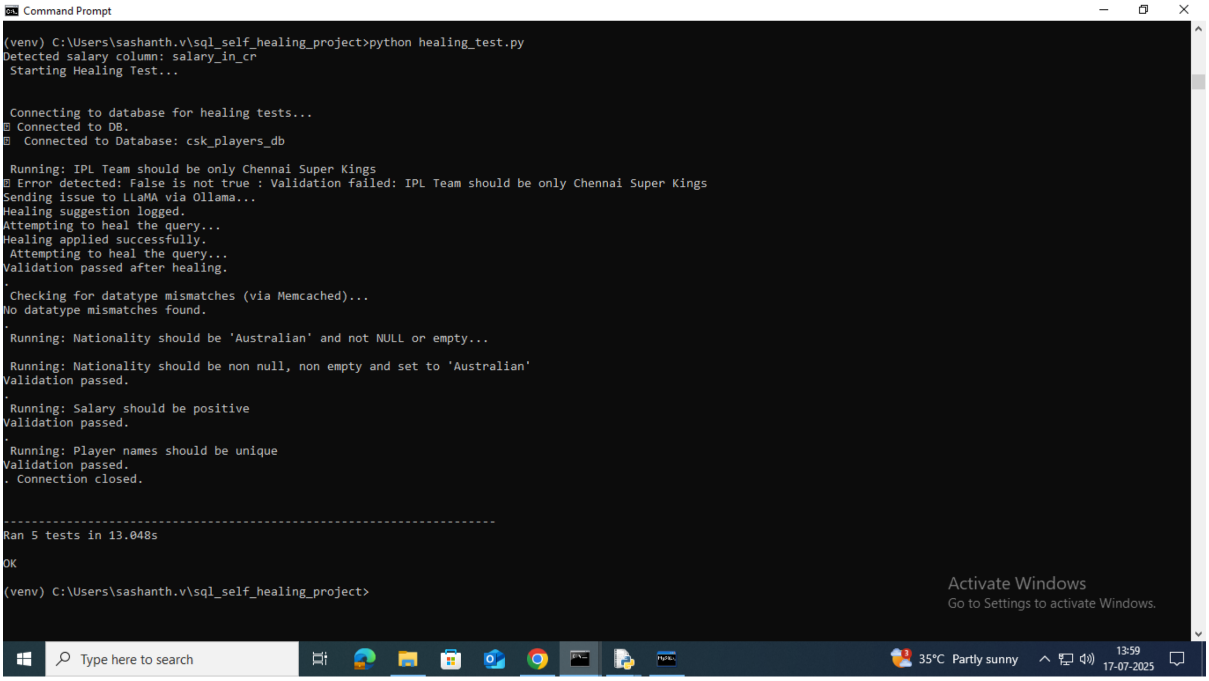
ID	Name	Age	Salary	Nationality	IPL TEAM	Matches played
1	Shane Watson	34	9.5	Australian	Rajasthan Royals	43
2	Dirk Nannes	29	2.5	Australian	Chennai Super Kings	5
3	Michael Hussey	36	2.5	Australian	Chennai Super Kings	64
4	Matthew Hayden	37	4.0	Australian	Chennai Super Kings	32
5	Doug Bollinger	29	3.0	Australian	Chennai Super Kings	41
6	Ben Hilfenhaus	28	2.0	Australian	Chennai Super Kings	21
7	George Bailey	30	1.5	Australian	Chennai Super Kings	4
8	Josh Hazlewood	30	2.0	Australian	Chennai Super Kings	12
9	John Hastings	27	1.0	Australian	Chennai Super Kings	2
10	Jason Behrendorff	31	1.5	Australian	Chennai Super Kings	5
11	Nathan Ellis	30	1.8	Australian	Chennai Super Kings	1

Fig18: The database with an invalid entry in the IPL TEAM column.



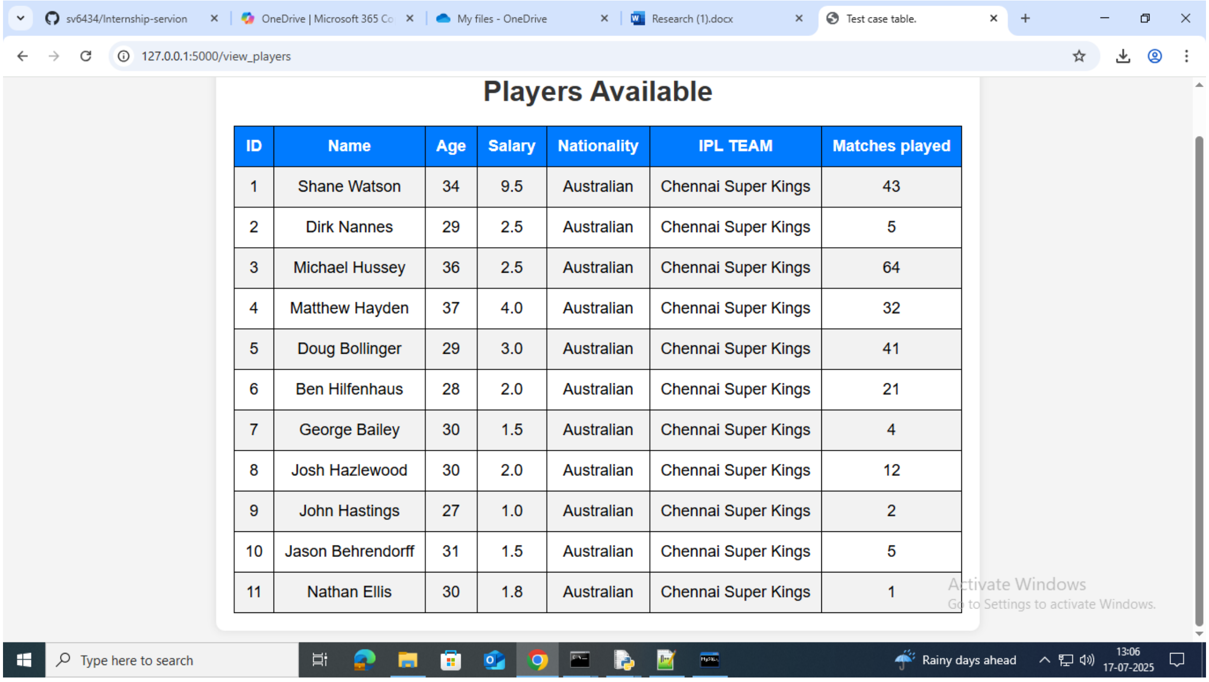
```
mysql> select * from players;
+----+-------------------+------------------+--------------+-------------+---------------------+----------------+
| id | name              | age_at_selection | salary_in_cr | nationality | ipl_team            | matches_played |
+----+-------------------+------------------+--------------+-------------+---------------------+----------------+
|  1 | Shane Watson      |               34 |          9.5 | Australian  | Rajasthan Royals    |             43 |
|  2 | Dirk Nannes       |               29 |          2.5 | Australian  | Chennai Super Kings |              5 |
|  3 | Michael Hussey    |               36 |          2.5 | Australian  | Chennai Super Kings |             64 |
|  4 | Matthew Hayden    |               37 |            4 | Australian  | Chennai Super Kings |             32 |
|  5 | Doug Bollinger    |               29 |            3 | Australian  | Chennai Super Kings |             41 |
|  6 | Ben Hilfenhaus    |               28 |            2 | Australian  | Chennai Super Kings |             21 |
|  7 | George Bailey     |               30 |          1.5 | Australian  | Chennai Super Kings |              4 |
|  8 | Josh Hazlewood    |               30 |            2 | Australian  | Chennai Super Kings |             12 |
|  9 | John Hastings     |               27 |            1 | Australian  | Chennai Super Kings |              2 |
| 10 | Jason Behrendorff |               31 |          1.5 | Australian  | Chennai Super Kings |              5 |
| 11 | Nathan Ellis      |               30 |          1.8 | Australian  | Chennai Super Kings |              1 |
+----+-------------------+------------------+--------------+-------------+---------------------+----------------+
11 rows in set (0.00 sec)

mysql> _
```

Fig19: Viewing the database in MySQL and seeing that there is an invalid entry in the ipl_team column.



```
(venv) C:\Users\sashanth.v\sql_self_healing_project>python healing_test.py
Detected salary column: salary_in_cr
 Starting Healing Test...


 Connecting to database for healing tests...
▯ Connected to DB.
▯  Connected to Database: csk_players_db

 Running: IPL Team should be only Chennai Super Kings
▯ Error detected: False is not true : Validation failed: IPL Team should be only Chennai Super Kings
Sending issue to LLaMA via Ollama...
Healing suggestion logged.
Attempting to heal the query...
Healing applied successfully.
 Attempting to heal the query...
Validation passed after healing.
.
 Checking for datatype mismatches (via Memcached)...
No datatype mismatches found.
.
 Running: Nationality should be 'Australian' and not NULL or empty...

 Running: Nationality should be non null, non empty and set to 'Australian'
Validation passed.
.
 Running: Salary should be positive
Validation passed.
.
 Running: Player names should be unique
Validation passed.
. Connection closed.


----------------------------------------------------------------------
Ran 5 tests in 13.048s

OK

(venv) C:\Users\sashanth.v\sql_self_healing_project>
```

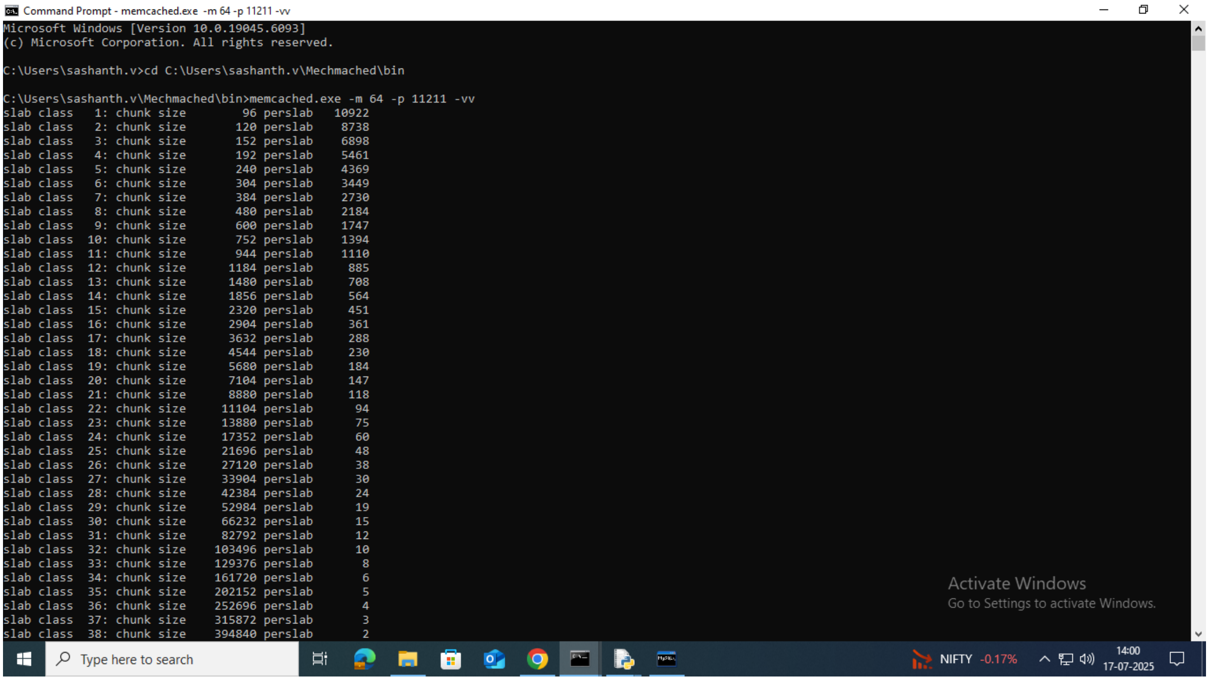
Fig20: Running the test via cmd.



Players Available

ID	Name	Age	Salary	Nationality	IPL TEAM	Matches played
1	Shane Watson	34	9.5	Australian	Chennai Super Kings	43
2	Dirk Nannes	29	2.5	Australian	Chennai Super Kings	5
3	Michael Hussey	36	2.5	Australian	Chennai Super Kings	64
4	Matthew Hayden	37	4.0	Australian	Chennai Super Kings	32
5	Doug Bollinger	29	3.0	Australian	Chennai Super Kings	41
6	Ben Hilfenhaus	28	2.0	Australian	Chennai Super Kings	21
7	George Bailey	30	1.5	Australian	Chennai Super Kings	4
8	Josh Hazlewood	30	2.0	Australian	Chennai Super Kings	12
9	John Hastings	27	1.0	Australian	Chennai Super Kings	2
10	Jason Behrendorff	31	1.5	Australian	Chennai Super Kings	5
11	Nathan Ellis	30	1.8	Australian	Chennai Super Kings	1

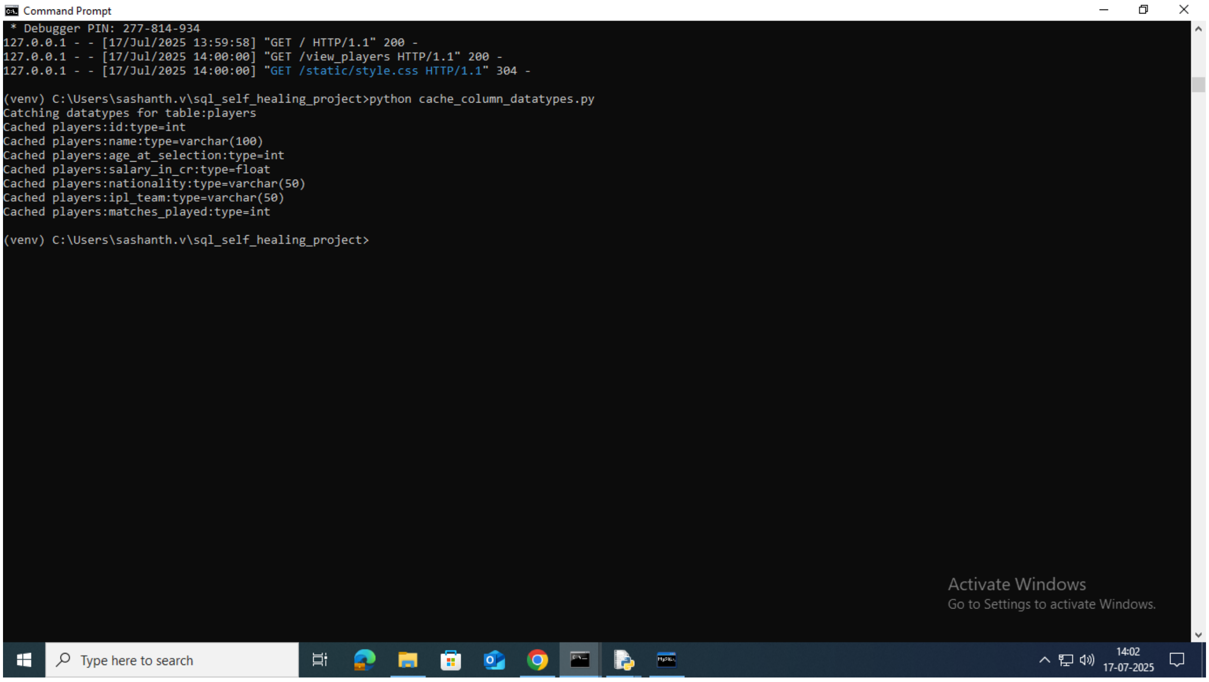
Fig21: Viewing the self-healed DB.



Command Prompt - memcached.exe -m 64 -p 11211 -vv
Activate Windows
Go to Settings to activate Windows.
Type here to search
NIFTY -0.17%
14:00
17-07-2025

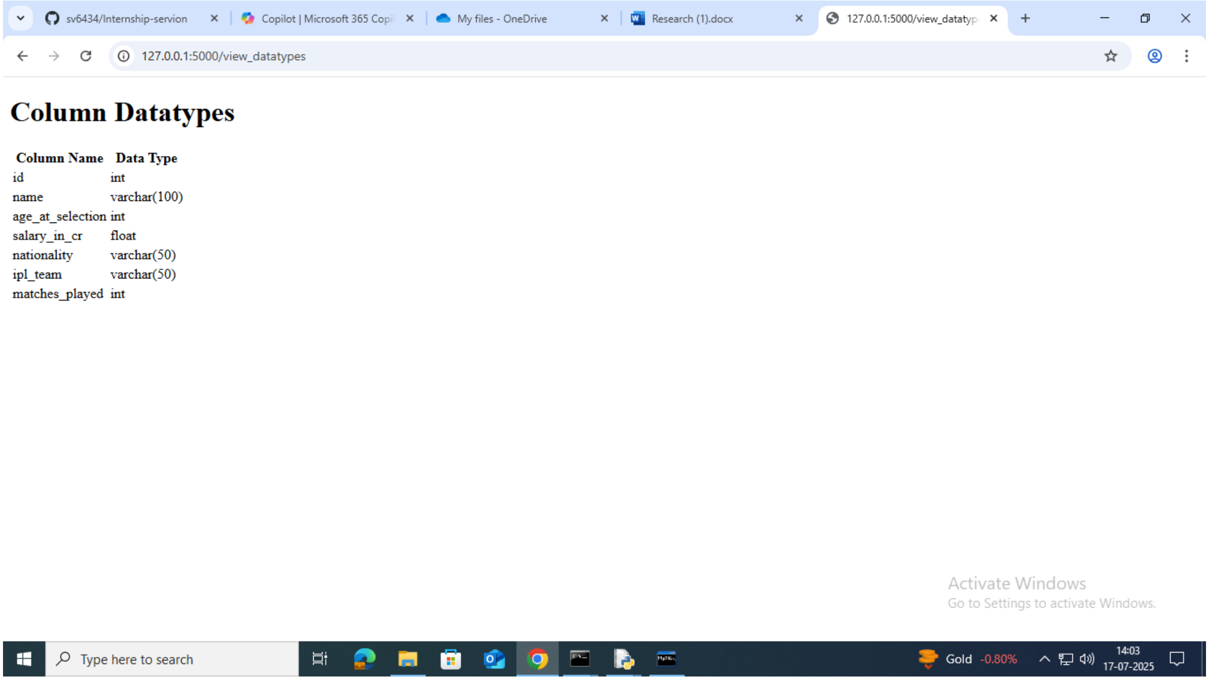
```
Microsoft Windows [Version 10.0.19045.6093]
(c) Microsoft Corporation. All rights reserved.

C:\Users\sashanth.v>cd C:\Users\sashanth.v\Mechmached\bin

C:\Users\sashanth.v\Mechmached\bin>memcached.exe -m 64 -p 11211 -vv
slab class   1: chunk size        96 perslab   10922
slab class   2: chunk size       120 perslab    8738
slab class   3: chunk size       152 perslab    6898
slab class   4: chunk size       192 perslab    5461
slab class   5: chunk size       240 perslab    4369
slab class   6: chunk size       304 perslab    3449
slab class   7: chunk size       384 perslab    2730
slab class   8: chunk size       480 perslab    2184
slab class   9: chunk size       600 perslab    1747
slab class  10: chunk size       752 perslab    1394
slab class  11: chunk size       944 perslab    1110
slab class  12: chunk size      1184 perslab     885
slab class  13: chunk size      1480 perslab     708
slab class  14: chunk size      1856 perslab     564
slab class  15: chunk size      2320 perslab     451
slab class  16: chunk size      2904 perslab     361
slab class  17: chunk size      3632 perslab     288
slab class  18: chunk size      4544 perslab     230
slab class  19: chunk size      5680 perslab     184
slab class  20: chunk size      7104 perslab     147
slab class  21: chunk size      8880 perslab     118
slab class  22: chunk size     11104 perslab      94
slab class  23: chunk size     13880 perslab      75
slab class  24: chunk size     17352 perslab      60
slab class  25: chunk size     21696 perslab      48
slab class  26: chunk size     27120 perslab      38
slab class  27: chunk size     33904 perslab      30
slab class  28: chunk size     42384 perslab      24
slab class  29: chunk size     52984 perslab      19
slab class  30: chunk size     66232 perslab      15
slab class  31: chunk size     82792 perslab      12
slab class  32: chunk size    103496 perslab      10
slab class  33: chunk size    129376 perslab       8
slab class  34: chunk size    161720 perslab       6
slab class  35: chunk size    202152 perslab       5
slab class  36: chunk size    252696 perslab       4
slab class  37: chunk size    315872 perslab       3
slab class  38: chunk size    394840 perslab       2
```

Fig22: Running the memcached.exe for testing the datatypes of our columns.



```
 * Debugger PIN: 277-814-934
127.0.0.1 - - [17/Jul/2025 13:59:58] "GET / HTTP/1.1" 200 -
127.0.0.1 - - [17/Jul/2025 14:00:00] "GET /view_players HTTP/1.1" 200 -
127.0.0.1 - - [17/Jul/2025 14:00:00] "GET /static/style.css HTTP/1.1" 304 -

(venv) C:\Users\sashanth.v\sql_self_healing_project>python cache_column_datatypes.py
Catching datatypes for table:players
Cached players:id:type=int
Cached players:name:type=varchar(100)
Cached players:age_at_selection:type=int
Cached players:salary_in_cr:type=float
Cached players:nationality:type=varchar(50)
Cached players:ipl_team:type=varchar(50)
Cached players:matches_played:type=int

(venv) C:\Users\sashanth.v\sql_self_healing_project>
```

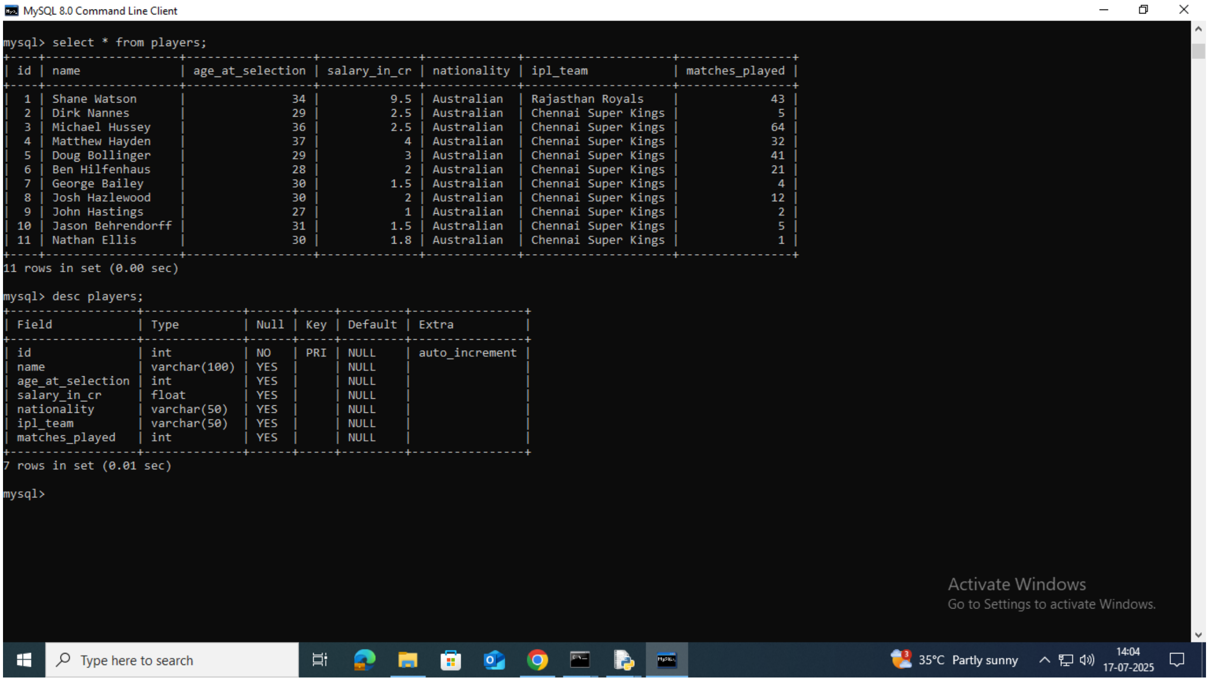
Fig23: Running the code cache_column_datatypes.py in cmd for caching the original datatypes oif each column.


sv6434/Internship-servion
Copilot | Microsoft 365 Copi
My files - OneDrive
Research (1).docx
127.0.0.1:5000/view_datatyp
127.0.0.1:5000/view_datatypes
Activate Windows
Go to Settings to activate Windows.
Type here to search
Gold -0.80%
14:03
17-07-2025

Column Datatypes

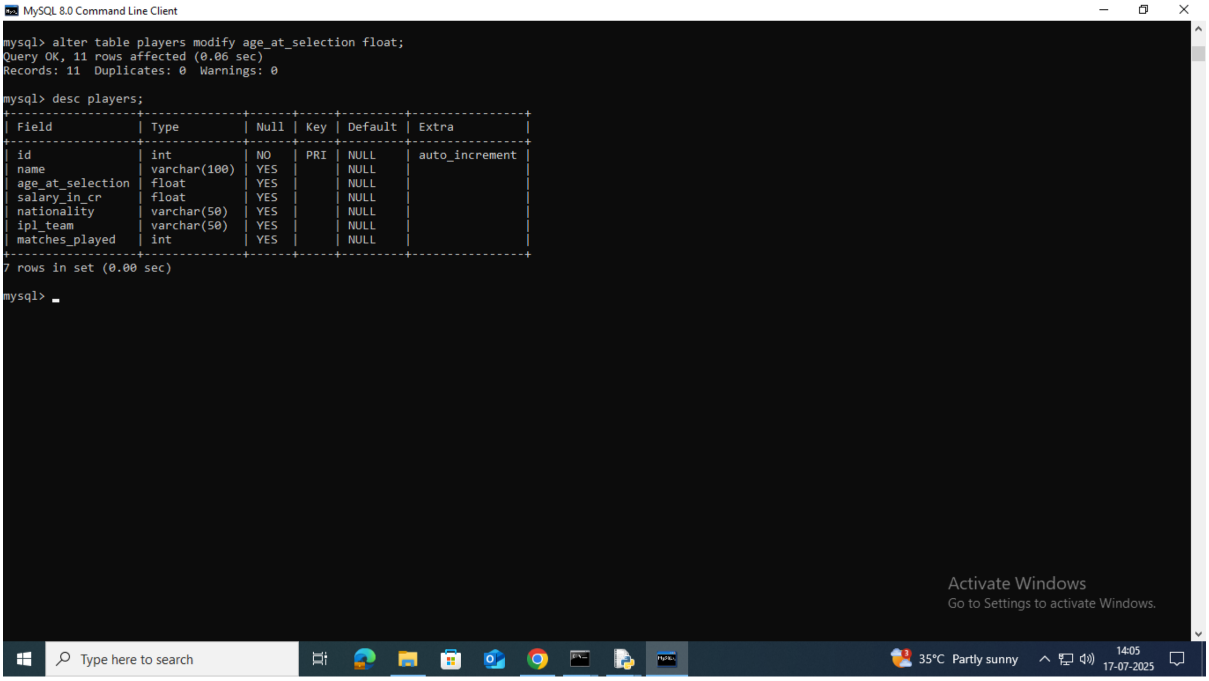
Column Name	Data Type
id	int
name	varchar(100)
age_at_selection	int
salary_in_cr	float
nationality	varchar(50)
ipl_team	varchar(50)
matches_played	int

Fig24: Viewing the datatypes of each column.



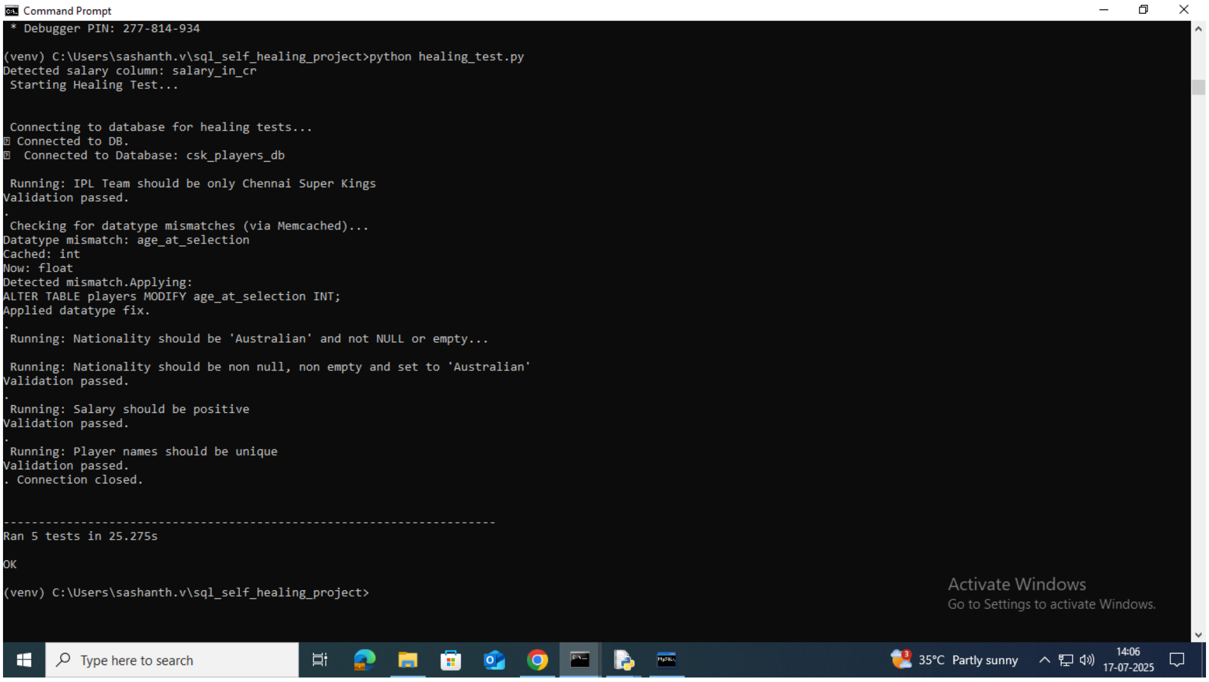
```
mysql> select * from players;
+----+-------------------+------------------+--------------+-------------+---------------------+----------------+
| id | name              | age_at_selection | salary_in_cr | nationality | ipl_team            | matches_played |
+----+-------------------+------------------+--------------+-------------+---------------------+----------------+
|  1 | Shane Watson      |               34 |          9.5 | Australian  | Rajasthan Royals    |             43 |
|  2 | Dirk Nannes       |               29 |          2.5 | Australian  | Chennai Super Kings |              5 |
|  3 | Michael Hussey    |               36 |          2.5 | Australian  | Chennai Super Kings |             64 |
|  4 | Matthew Hayden    |               37 |            4 | Australian  | Chennai Super Kings |             32 |
|  5 | Doug Bollinger    |               29 |            3 | Australian  | Chennai Super Kings |             41 |
|  6 | Ben Hilfenhaus    |               28 |            2 | Australian  | Chennai Super Kings |             21 |
|  7 | George Bailey     |               30 |          1.5 | Australian  | Chennai Super Kings |              4 |
|  8 | Josh Hazlewood    |               30 |            2 | Australian  | Chennai Super Kings |             12 |
|  9 | John Hastings     |               27 |            1 | Australian  | Chennai Super Kings |              2 |
| 10 | Jason Behrendorff |               31 |          1.5 | Australian  | Chennai Super Kings |              5 |
| 11 | Nathan Ellis      |               30 |          1.8 | Australian  | Chennai Super Kings |              1 |
+----+-------------------+------------------+--------------+-------------+---------------------+----------------+
11 rows in set (0.00 sec)

mysql> desc players;
+------------------+--------------+------+-----+---------+----------------+
| Field            | Type         | Null | Key | Default | Extra          |
+------------------+--------------+------+-----+---------+----------------+
| id               | int          | NO   | PRI | NULL    | auto_increment |
| name             | varchar(100) | YES  |     | NULL    |                |
| age_at_selection | int          | YES  |     | NULL    |                |
| salary_in_cr     | float        | YES  |     | NULL    |                |
| nationality      | varchar(50)  | YES  |     | NULL    |                |
| ipl_team         | varchar(50)  | YES  |     | NULL    |                |
| matches_played   | int          | YES  |     | NULL    |                |
+------------------+--------------+------+-----+---------+----------------+
7 rows in set (0.01 sec)

mysql>
```

Fig25: Viewing the datatypes of each column at MySQL.



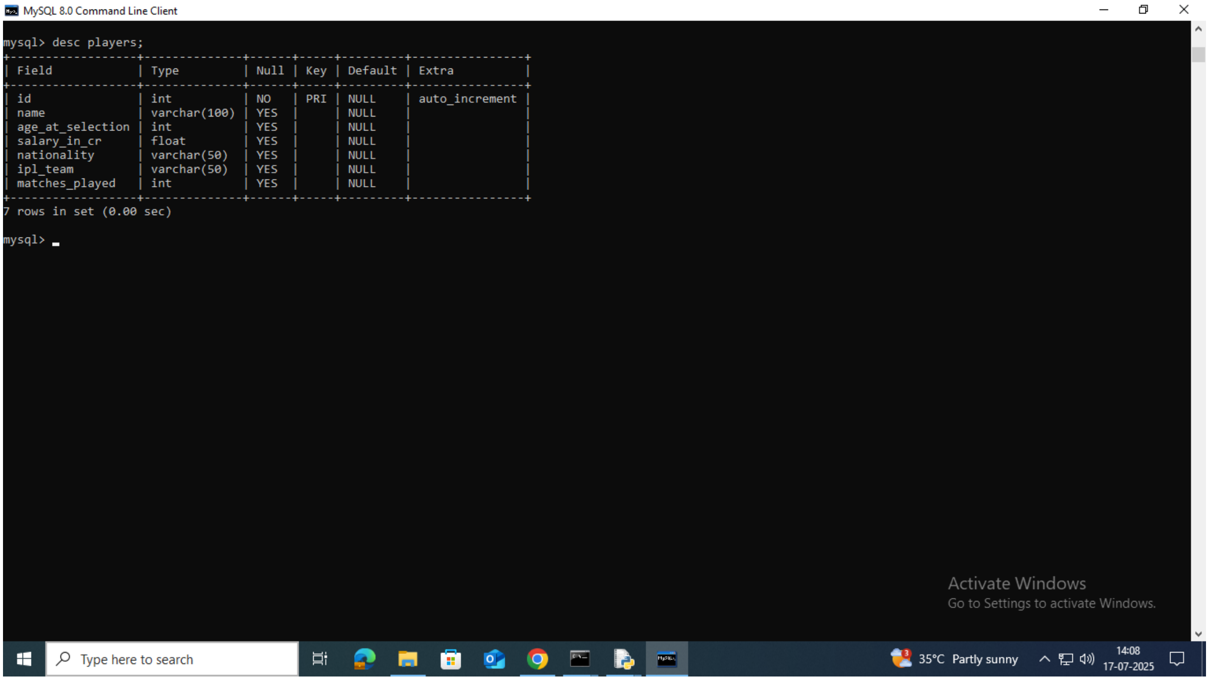
```
mysql> alter table players modify age_at_selection float;
Query OK, 11 rows affected (0.06 sec)
Records: 11  Duplicates: 0  Warnings: 0

mysql> desc players;
+------------------+--------------+------+-----+---------+----------------+
| Field            | Type         | Null | Key | Default | Extra          |
+------------------+--------------+------+-----+---------+----------------+
| id               | int          | NO   | PRI | NULL    | auto_increment |
| name             | varchar(100) | YES  |     | NULL    |                |
| age_at_selection | float        | YES  |     | NULL    |                |
| salary_in_cr     | float        | YES  |     | NULL    |                |
| nationality      | varchar(50)  | YES  |     | NULL    |                |
| ipl_team         | varchar(50)  | YES  |     | NULL    |                |
| matches_played   | int          | YES  |     | NULL    |                |
+------------------+--------------+------+-----+---------+----------------+
7 rows in set (0.00 sec)

mysql> _
```

Fig26: Changing the datatype of the age column from int to float.



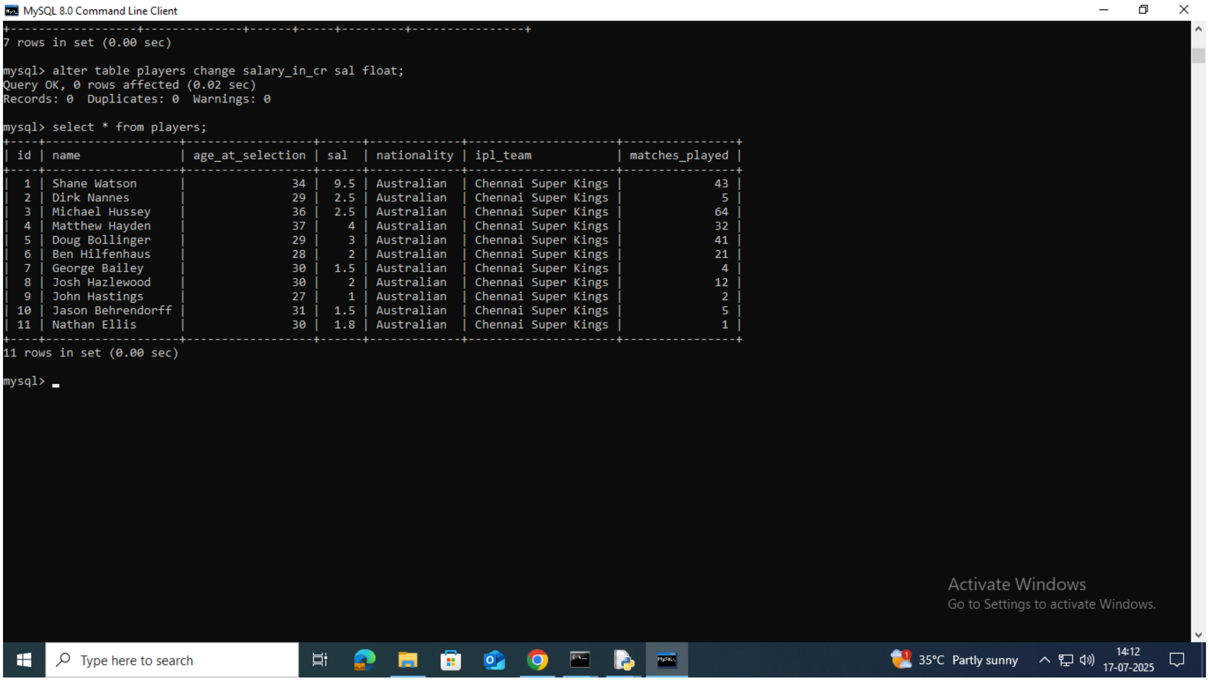
```
 * Debugger PIN: 277-814-934

(venv) C:\Users\sashanth.v\sql_self_healing_project>python healing_test.py
Detected salary column: salary_in_cr
 Starting Healing Test...


 Connecting to database for healing tests...
□ Connected to DB.
□  Connected to Database: csk_players_db

 Running: IPL Team should be only Chennai Super Kings
Validation passed.
.
 Checking for datatype mismatches (via Memcached)...
Datatype mismatch: age_at_selection
Cached: int
Now: float
Detected mismatch.Applying:
ALTER TABLE players MODIFY age_at_selection INT;
Applied datatype fix.
.
 Running: Nationality should be 'Australian' and not NULL or empty...

 Running: Nationality should be non null, non empty and set to 'Australian'
Validation passed.
.
 Running: Salary should be positive
Validation passed.
.
 Running: Player names should be unique
Validation passed.
. Connection closed.


----------------------------------------------------------------------
Ran 5 tests in 25.275s

OK

(venv) C:\Users\sashanth.v\sql_self_healing_project>
```

Fig27: Running the tests via cmd. Getting healed.



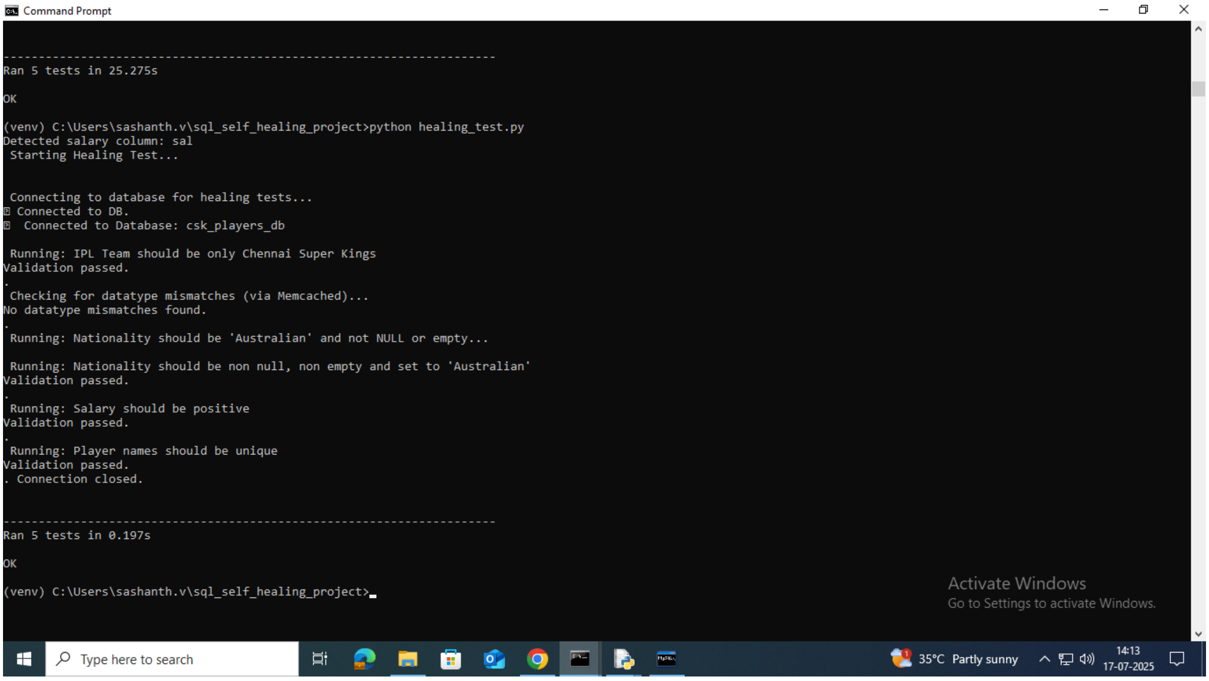
```
mysql> desc players;
+-----------------+--------------+------+-----+---------+----------------+
| Field           | Type         | Null | Key | Default | Extra          |
+-----------------+--------------+------+-----+---------+----------------+
| id              | int          | NO   | PRI | NULL    | auto_increment |
| name            | varchar(100) | YES  |     | NULL    |                |
| age_at_selection | int         | YES  |     | NULL    |                |
| salary_in_cr    | float        | YES  |     | NULL    |                |
| nationality     | varchar(50)  | YES  |     | NULL    |                |
| ipl_team        | varchar(50)  | YES  |     | NULL    |                |
| matches_played  | int          | YES  |     | NULL    |                |
+-----------------+--------------+------+-----+---------+----------------+
7 rows in set (0.00 sec)

mysql> _
```

Fig28: Viewing the self-healed in the datatypes of columns.



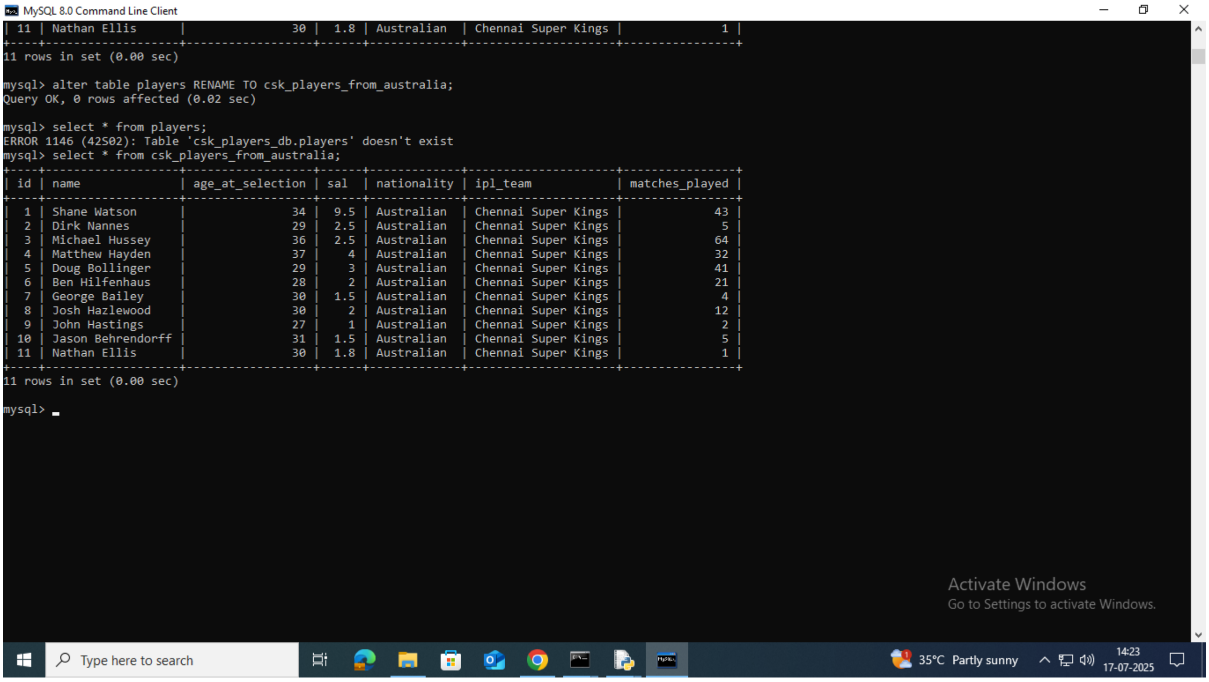
```
+-----------------+--------------+------+-----+---------+----------------+
7 rows in set (0.00 sec)

mysql> alter table players change salary_in_cr sal float;
Query OK, 0 rows affected (0.02 sec)
Records: 0  Duplicates: 0  Warnings: 0

mysql> select * from players;
+----+-------------------+------------------+------+-------------+---------------------+----------------+
| id | name              | age_at_selection | sal  | nationality | ipl_team            | matches_played |
+----+-------------------+------------------+------+-------------+---------------------+----------------+
|  1 | Shane Watson      |               34 |  9.5 | Australian  | Chennai Super Kings |             43 |
|  2 | Dirk Nannes       |               29 |  2.5 | Australian  | Chennai Super Kings |              5 |
|  3 | Michael Hussey    |               36 |  2.5 | Australian  | Chennai Super Kings |             64 |
|  4 | Matthew Hayden    |               37 |    4 | Australian  | Chennai Super Kings |             32 |
|  5 | Doug Bollinger    |               29 |    3 | Australian  | Chennai Super Kings |             41 |
|  6 | Ben Hilfenhaus    |               28 |    2 | Australian  | Chennai Super Kings |             21 |
|  7 | George Bailey     |               30 |  1.5 | Australian  | Chennai Super Kings |              4 |
|  8 | Josh Hazlewood    |               30 |    2 | Australian  | Chennai Super Kings |             12 |
|  9 | John Hastings     |               27 |    1 | Australian  | Chennai Super Kings |              2 |
| 10 | Jason Behrendorff |               31 |  1.5 | Australian  | Chennai Super Kings |              5 |
| 11 | Nathan Ellis      |               30 |  1.8 | Australian  | Chennai Super Kings |              1 |
+----+-------------------+------------------+------+-------------+---------------------+----------------+
11 rows in set (0.00 sec)

mysql> _
```

Fig29: Changing the column header name from salary_in_cr to sal.



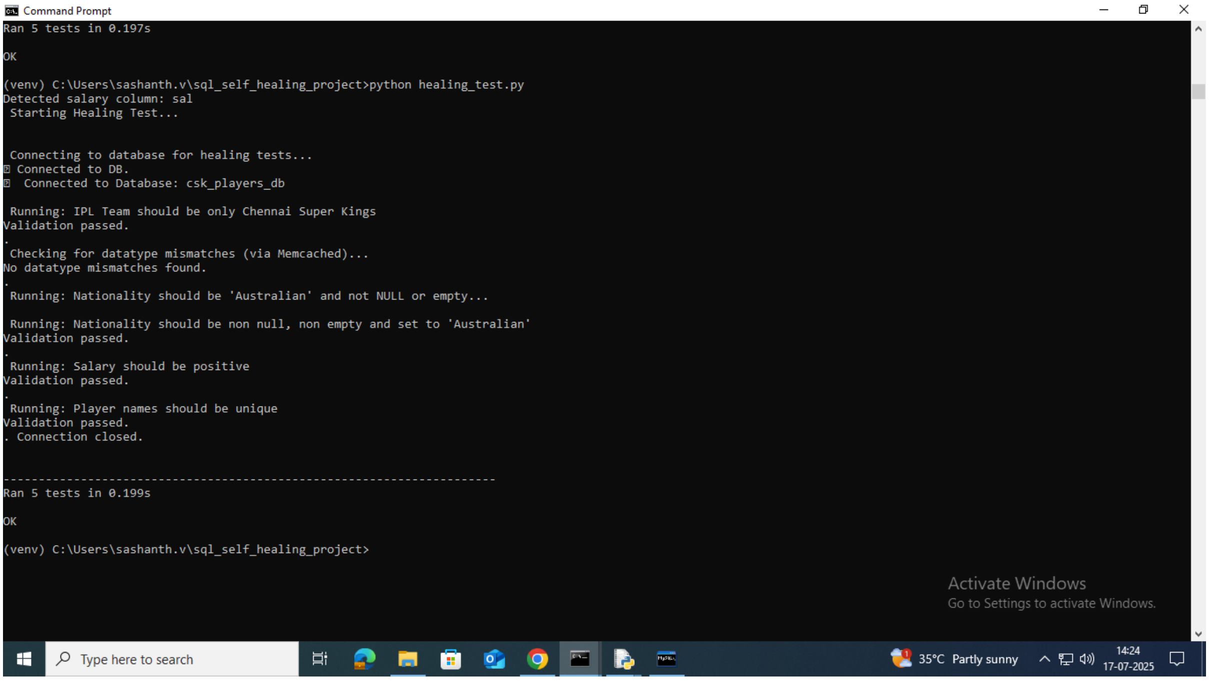
```
----------------------------------------------------------------------
Ran 5 tests in 25.275s

OK

(venv) C:\Users\sashanth.v\sql_self_healing_project>python healing_test.py
Detected salary column: sal
 Starting Healing Test...


 Connecting to database for healing tests...
□ Connected to DB.
□  Connected to Database: csk_players_db

 Running: IPL Team should be only Chennai Super Kings
Validation passed.
.
 Checking for datatype mismatches (via Memcached)...
No datatype mismatches found.
.
 Running: Nationality should be 'Australian' and not NULL or empty...

 Running: Nationality should be non null, non empty and set to 'Australian'
Validation passed.
.
 Running: Salary should be positive
Validation passed.
.
 Running: Player names should be unique
Validation passed.
. Connection closed.


----------------------------------------------------------------------
Ran 5 tests in 0.197s

OK

(venv) C:\Users\sashanth.v\sql_self_healing_project>
```

Fig30: The testing via cmd. The testing works even when the salary column name changes as we have used dynamic detection for identifying the salary column. We can observe here during testing that the self-healing agent Ollama identifies the column related to salary via certain keywords which we have provided and then proceeds to the testing of database. All tests are passed means that all the test-cases are valid and have been completed successfully.



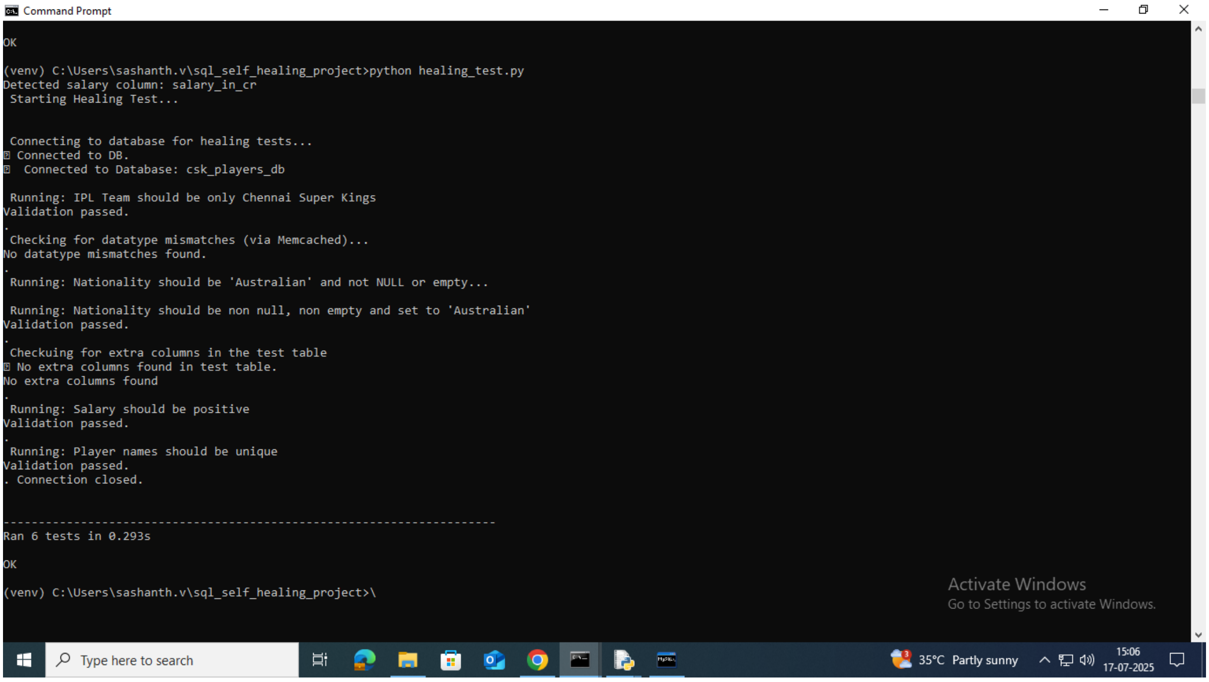
```
| 11 | Nathan Ellis      |               30 |  1.8 | Australian  | Chennai Super Kings |              1 |
+----+-------------------+------------------+------+-------------+---------------------+----------------+
11 rows in set (0.00 sec)

mysql> alter table players RENAME TO csk_players_from_australia;
Query OK, 0 rows affected (0.02 sec)

mysql> select * from players;
ERROR 1146 (42S02): Table 'csk_players_db.players' doesn't exist
mysql> select * from csk_players_from_australia;
+----+-------------------+------------------+------+-------------+---------------------+----------------+
| id | name              | age_at_selection | sal  | nationality | ipl_team            | matches_played |
+----+-------------------+------------------+------+-------------+---------------------+----------------+
|  1 | Shane Watson      |               34 |  9.5 | Australian  | Chennai Super Kings |             43 |
|  2 | Dirk Nannes       |               29 |  2.5 | Australian  | Chennai Super Kings |              5 |
|  3 | Michael Hussey    |               36 |  2.5 | Australian  | Chennai Super Kings |             64 |
|  4 | Matthew Hayden    |               37 |    4 | Australian  | Chennai Super Kings |             32 |
|  5 | Doug Bollinger    |               29 |    3 | Australian  | Chennai Super Kings |             41 |
|  6 | Ben Hilfenhaus    |               28 |    2 | Australian  | Chennai Super Kings |             21 |
|  7 | George Bailey     |               30 |  1.5 | Australian  | Chennai Super Kings |              4 |
|  8 | Josh Hazlewood    |               30 |    2 | Australian  | Chennai Super Kings |             12 |
|  9 | John Hastings     |               27 |    1 | Australian  | Chennai Super Kings |              2 |
| 10 | Jason Behrendorff |               31 |  1.5 | Australian  | Chennai Super Kings |              5 |
| 11 | Nathan Ellis      |               30 |  1.8 | Australian  | Chennai Super Kings |              1 |
+----+-------------------+------------------+------+-------------+---------------------+----------------+
11 rows in set (0.00 sec)

mysql>
```

Fig31: Changing the name of the table from players to csk_players_from_australia.



```
Ran 5 tests in 0.197s

OK

(venv) C:\Users\sashanth.v\sql_self_healing_project>python healing_test.py
Detected salary column: sal
 Starting Healing Test...


 Connecting to database for healing tests...
□ Connected to DB.
□  Connected to Database: csk_players_db

 Running: IPL Team should be only Chennai Super Kings
Validation passed.
.
 Checking for datatype mismatches (via Memcached)...
No datatype mismatches found.
.
 Running: Nationality should be 'Australian' and not NULL or empty...

 Running: Nationality should be non null, non empty and set to 'Australian'
Validation passed.
.
 Running: Salary should be positive
Validation passed.
.
 Running: Player names should be unique
Validation passed.
. Connection closed.


----------------------------------------------------------------------
Ran 5 tests in 0.199s

OK

(venv) C:\Users\sashanth.v\sql_self_healing_project>
```

Fig32: Running the test via cmd. The testing works as we have also used the concept of dynamic detection for identifying the table name. We can observe here during testing that the self-healing agent Ollama identifies the table name and then proceeds to the testing of database. All tests are passed means that all the test-cases are valid and have been completed successfully.



```
OK

(venv) C:\Users\sashanth.v\sql_self_healing_project>python healing_test.py
Detected salary column: salary_in_cr
 Starting Healing Test...


 Connecting to database for healing tests...
□ Connected to DB.
□  Connected to Database: csk_players_db

 Running: IPL Team should be only Chennai Super Kings
Validation passed.
.
 Checking for datatype mismatches (via Memcached)...
No datatype mismatches found.
.
 Running: Nationality should be 'Australian' and not NULL or empty...

 Running: Nationality should be non null, non empty and set to 'Australian'
Validation passed.
.
 Checkuing for extra columns in the test table
□ No extra columns found in test table.
No extra columns found
.
 Running: Salary should be positive
Validation passed.
.
 Running: Player names should be unique
Validation passed.
. Connection closed.


----------------------------------------------------------------------
Ran 6 tests in 0.293s

OK

(venv) C:\Users\sashanth.v\sql_self_healing_project>\
```

Fig33: Running the test for identifying any extra columns present in the database. If identified, it asks user permission for removing it and if yes it removes else it retains.

Result: Thus, self-healing in a database has been observed successfully and we are able to identify that the test-cases have been validated.

GitHub Link: https://github.com/sv6434/Internship-servion