



ARTI 401– Artificial Intelligence: Principles and techniques

Term 1 – 2023/2024

Project Report Template

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***Saudi League*: Analysis System of the Saudi Football League**

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Abstract (Executive Summary)

The project involves designing and developing an expert system that facilitates the analysis of the Saudi Professional League (SPL) for various stakeholders, including coaches, players, and fans. Prolog programming language is used to implement the system, which utilizes data from the official SPL website. Teams, matches, and players are the three main analytical types of the system. There are 130 matches between 18 football teams in the 2023-2024 season, which provides insights into the performance of teams, matches, and players. Using the expert system, users can gain comprehensive insight into the SPL, enabling informed decisions and deeper understanding.

Chapter 1: Overview of the system

Introduction

The Saudi football league is one of the most popular and competitive leagues in Asia. In recent years, the league has attracted a number of high-profile players and coaches, leading to a significant increase in the level of competition. Our proposed project, titled "Saudi League: Analysis System of the Saudi Football League," aims to develop a sophisticated expert system capable of providing comprehensive and insightful analysis that empowers stakeholders to make informed decisions. By harnessing the power of data-driven analysis, our system will provide users with a deeper understanding of the factors that drive team performance. This will arm stakeholders with the knowledge they need to gain an edge in the ever-evolving landscape of the Saudi football league. Utilizing cutting-edge artificial intelligence techniques, the system will be able to identify patterns and trends that would otherwise go unnoticed as it can predict match outcomes. The outcome of our project is not merely a tool for analysis, but a catalyst for change. By providing stakeholders with the insights they need to make informed decisions, as the system has the potential to elevate the standard of play in the Saudi Football League, fostering a more competitive and exciting environment for all involved.

1.1 Problem Statement

The Saudi football league is a complex system with a multitude of factors influencing team performance. These factors include historical data, team rankings, player form, injuries, and psychological elements. The sheer volume and complexity of this data make it challenging for stakeholders to gain a comprehensive understanding of the factors that drive team performance. As a result, stakeholders often struggle to make informed decisions about players, tactics, and transfers.

1.2 Motivation

We're motivated by this project that aims to address the aforementioned problem by developing an expert system capable of providing a comprehensive and insightful analysis of the Saudi football league. This system will utilize cutting-edge artificial intelligence techniques to identify patterns and trends that would otherwise go unnoticed so the system can be able to predict the match outcomes. By providing stakeholders with a deeper understanding of the factors that drive team performance, the system will empower them to make more informed decisions.

In addition to the aforementioned motivation, the following factors also contribute to the need for this project:

The increasing popularity of data-driven analysis in the sports industry.

The growing demand for expert insights into the Saudi football league.

The potential for the system to contribute to the development of more effective training programs and injury prevention strategies.

Hopefully, the successful development of this project will have a significant impact on the Saudi football league. By providing stakeholders with the information, they need to make informed decisions, the system has the potential to elevate the standard of play, foster a more competitive environment, and contribute to the overall growth and development of the league.

1.3 Objectives

- General objectives:
 - To provide a comprehensive and insightful analysis of the Saudi football league.
 - To help users understand the factors that drive team performance.
 - To give stakeholders the knowledge they need to make better decisions.
 - To elevate the standard of play in the Saudi football league.
 - To foster a more competitive and exciting environment.
 - To enhance the system's functionality and capabilities
- Specific objectives:
 - To develop a system that can be used by a variety of stakeholders.
 - To make the system easy to use and understand.
 - To keep the system updated with the latest data and analysis.
 - To make the system accessible to a wide range of users.
 - To enable the system to predict match outcomes with a high degree of accuracy.

Using the Saudi League Analysis System, people can make better decisions about the Saudi football league. Using cutting-edge technology, it will analyze the league comprehensively and insightfully.

Coaches, players, scouts, team executives, and fans will all be able to use the system easily. People will always be able to make informed decisions using the latest data and analysis.

Saudi League Analysis System aims to help the Saudi football league reach its full potential. It can increase the performance, competitiveness, and attractiveness of the league by empowering people to make better decisions.

1.4 Limitation

There is a limit to the system's performance due to the quality and availability of the data collected from the SPL website. It is possible for the system's analysis and predictions to be flawed if the data is incomplete or inaccurate. Further, the system must be capable of handling large and complex data sets, such as match data, statistics on teams, and information on players. In order to extract meaningful insights from this data, sophisticated data processing and machine learning techniques are required. The accuracy of the machine learning models will also determine how accurate the system is at predicting future outcomes, such as match scores and player performance. It is essential that these models are continuously updated and improved in order for them to remain effective. It is also important to note that football is constantly evolving, with new tactics, strategies, and dynamics being introduced all the time. In order to remain relevant and accurate, the system needs to adapt to these changes.

1.5 Notations

Abbreviations	Detail
SPL	Saudi Professional League
CNN	Convolutional neural network
GPS	Global Positioning System
k-NN	k-Nearest Neighbor
LB	LogitBoost
RF	Random Forest
SVM	Support Vector Machine
CB	Cat Boost

Chapter 2: Literature Survey

- The study “Automated Pre-Play Analysis of American Football Formations Using Deep Learning” [1] by Jacob DeLoy Newman proposes a deep learning model to automatically analyze American football formations from video footage. The model is based on a convolutional neural network (CNN), which is a type of deep learning model that is well-suited for image classification and object detection tasks.

The model was trained on a dataset of over 100,000 American football plays, each of which was manually annotated with the frame in which the offensive team is lined up in a formation, the line of scrimmage, and the type of formation of the offensive team. The model was evaluated on a held-out test set of over 10,000 plays, and it achieved an accuracy of 95% on identifying the frame in which the offensive team is lined up in a formation, 98% accuracy on identifying the line of scrimmage, and 84.8% accuracy on identifying the type of formation.

One of the limitations of the model is that it is trained on a dataset of American football plays. This means that the model may not be able to accurately identify formations in other sports, such as basketball or soccer. Additionally, the model is trained on a dataset of plays from a single season. This means that the model may not be able to accurately identify formations from different seasons, or from games that are played on different fields or under different weather conditions.

Overall, Newman's research demonstrates the feasibility of using deep learning to automate the analysis of American football formations. This could have a major impact on the sports industry, as it would allow coaches, players, and analysts to access valuable insights about their teams and opponents much more quickly and easily. However, it is important to note that the model has some limitations, such as its inability to generalize to other sports or seasons.

In addition to the limitations mentioned above, it is also important to note that deep learning models can be biased. This means that if the training data is biased, the model will also be biased. For example, if the training data contains more plays from one team than another, the model may be more likely to identify formations from that team. It is therefore important to carefully curate the training data and to evaluate the model on a held-out test set to ensure that it is not biased.

- The study "Recognizing Team Formation in American Football" [2] by Indriyati Atmosukarto, Bernard Ghanem, Mohamed Magdy Mohamed Nasef Saadalla, and Narendra Ahuja proposes a novel framework

for automatically recognizing the formation of the offensive team in American football from video footage.

The framework is based on a deep learning model that is able to identify the players in the video, determine their positions, and infer the formation of the offensive team. The model was trained on a dataset of real-world American football games, and it achieved an accuracy of 95% in detecting the formation frame, 98% accuracy in detecting the line of scrimmage, and up to 67% accuracy in classifying the offensive team's formation.

The framework has the potential to be used for a variety of applications, such as:

Helping coaches and analysts to scout opponents and develop game plans

Generating statistics on team formations and play calls

Developing new training tools for players

One of the limitations of the framework is that it is trained on a dataset of American football plays. This means that the framework may not be able to accurately identify formations in other sports, such as basketball or soccer. Additionally, the framework is trained on a dataset of plays from a single season. This means that the framework may not be able to accurately identify formations from different seasons, or from games that are played on different fields or under different weather conditions.

Overall, the framework proposed in the paper "Recognizing Team Formation in American Football" is a promising new approach for automatic formation recognition. The framework has the potential to be used for a variety of applications, and it could help to improve the performance of American football teams. However, it is important to note that the framework has some limitations, such as its inability to generalize to other sports or seasons.

In addition to the limitations mentioned above, it is also important to note that deep learning models can be biased. This means that if the training data is biased, the model will also be biased. For example, if the training data contains more plays from one team than another, the model may be more likely to identify formations from that team. It is therefore important to carefully curate the training data and to evaluate the model on a held-out test set to ensure that it is not biased.

- The study "Running performance in Brazilian professional football players during a congested match schedule" [3] investigated the influence of playing congested fixtures (two matches per week) on running performance of Brazilian professional football players. A GPS device was used to monitor the performance of forty players during 59 official matches over three competitive seasons. Distance covered, high-intensity distance (HIA; >15 km/h) and mean speed (VAVERAGE) were assessed as indicators of running performance. Compared to non-congested matches, players covered greater total distances ($p = 0.004$; $d = 0.26$); and HIA ($p = 0.012$; $d = 0.24$); during congested matches. However, individualized data analysis showed that players covered reduced HIA during congested fixtures when playing in national leagues ($p = 0.033$; $d = 0.24$) or when playing in the forward position ($p = 0.006$; $d = 0.70$). According to these findings, congested fixtures may have a different effect on runners depending on their position and their competitive level.

This study has limitations such as not controlling for other factors that might have influenced running performance, the inclusion of only male football players from a single league, the use of running performance as a proxy for fatigue, and the absence of a control group. This study examined only the effects of playing congested matches on running performance. Furthermore, the study failed to examine optimal recovery strategies for players in congested periods, long-term effects of playing congested fixtures on running performance and injuries, or the impacts on player well-being of congested fixtures.

- The study "On Predicting Soccer Outcomes in the Greek League Using Machine Learning" [4] investigated the use of machine learning models to predict soccer outcomes in the Greek Super League. In addition to data cleaning and feature engineering, the authors optimized hyperparameters by using a variety of methodologies. Five machine learning models were evaluated: k-Nearest Neighbor (k-NN), LogitBoost (LB), Support Vector Machine (SVM), Random Forest (RF), and CatBoost (CB).

As a result of the analysis, the CB model showed the highest prediction accuracy, with a prediction accuracy of 67.73%. The other models achieved accuracies ranging from 62.35% to 65.12%. The authors found that the most important features for predicting soccer outcomes were team strength, home-field advantage, and recent form.

Using machine learning to predict soccer outcomes may be a useful tool, according to this study. Predicting soccer outcomes in the Greek Super League was shown to be particularly promising with the CB model. The study's findings could be used to inform the development of betting strategies and to assist coaches in making informed decisions about player selection and tactics.

A number of limitations exist in this study, including the consideration of only a small number of features, an examination of data from only the Greek Super League, and being unable to compare machine learning models with human experts.

- The study “pi-football: A Bayesian network model for forecasting Association Football match outcomes” [5] represents the relationships between variables that are relevant to the outcome of an Association Football match. These variables include:
 - Factors selected by objective measurements include roster strength, home advantage, recent form, goals scored, goals conceded, shots on target, shots off target, possession, tackles won, fouls committed, and yellow and red cards.
 - Subjective factors: team news, expert opinion, and injuries.

Based on these variables, the model calculates the probability of each possible outcome (home win, draw, away win). By incorporating both objective and subjective information, the model can make more informed predictions than models based solely on objective data.

During the 2010/11 season, data from the English Premier League (EPL) were used to evaluate the model. According to the results, the model was able to predict the outcome of matches with an accuracy of 63.3% for home wins, 60.0% for draws, and 68.3% for away wins. With a profit of 1.3% over the course of the season, the model also outperformed the bookmakers' odds.

Using Bayesian network models for forecasting Association Football matches may be a useful tool. Pi-football makes more informed predictions because objective and subjective information can be incorporated, so it can make more informed predictions than models with only objective information. As well as predicting match outcomes accurately, the model has outperformed bookmakers' odds.

The limitations include its reliance on the accuracy of input data, its exclusion of factors such as player morale, referee decisions, and weather conditions, and its difficulty in interpreting its predictions due to its complexity, including the inability to accurately predict the results of matches involving teams that have recently changed their playing style or personnel.

Chapter 3: System development and implementation

3.1 System Diagram

Figure 1 gives a comprehensive view of the system and the users' interaction with the expert system. The user must enter the team so that the expert system can verify the validity of the team by searching for the team in the expert system's database. After that, he collects data related to the team and analyzes it until he reaches results that enable him to present the best lineup, predict the outcome of the match, and provide a set of data and graphs related to the analysis.

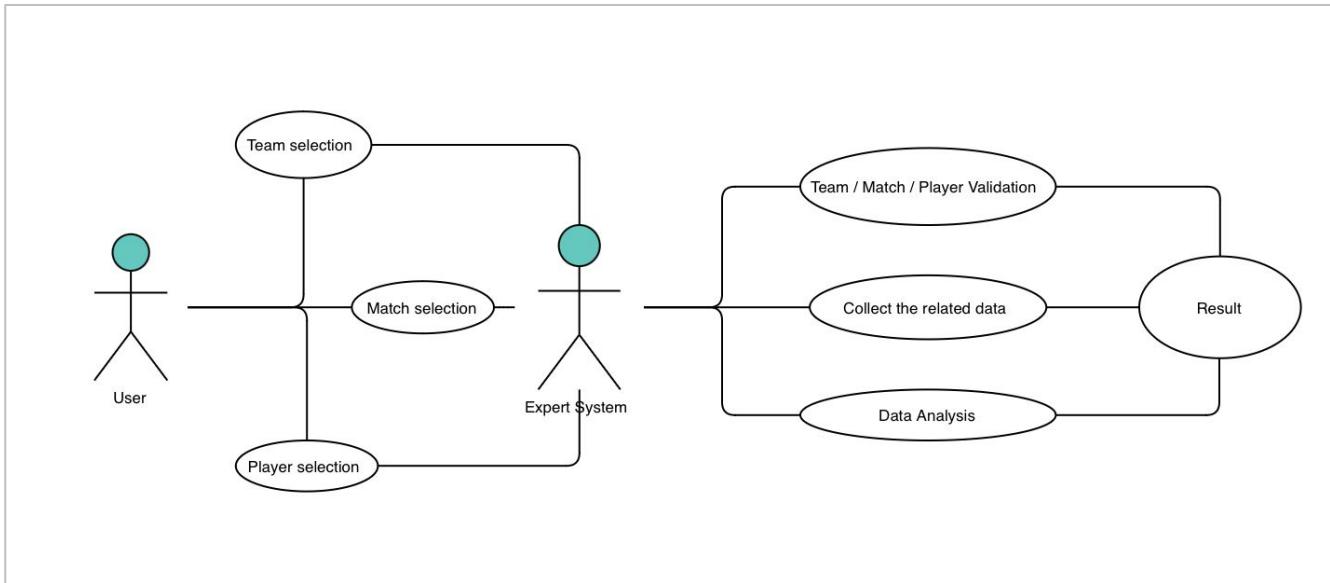


Figure 1: Use case diagram.

3.2 System Prototype

3.2.1 Sign in

The first page will show to the user is the sign in page, as shown in figure 2 the sign in page contains several types for signing in such as signing in with email, Apple account, Facebook account and google account. It also provides a section for creating a new account.

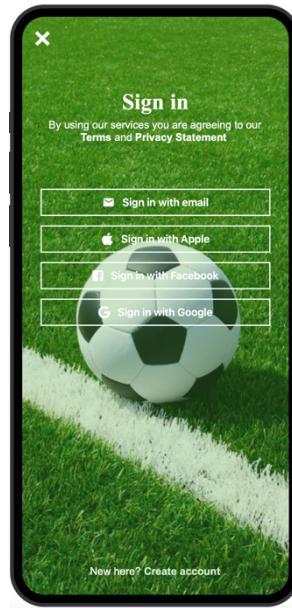


Figure 2: Sign in.

3.2.2 Homepage

In figure 2, the homepage contains navigate bar and statistics and results from our knowledge base.

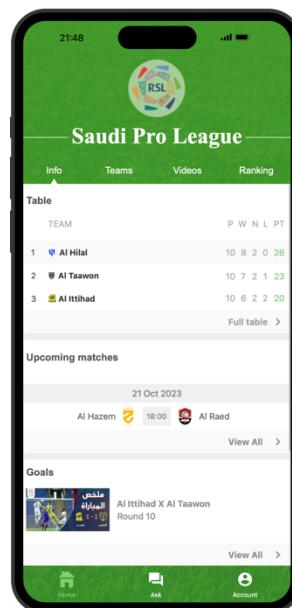


Figure 3: Homepage.

3.2.3 Teams Page

Figure 3 the teams page contains all the teams and their information.

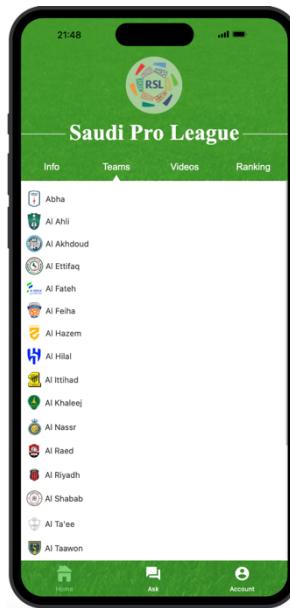


Figure 4: Teams Page.

3.2.4 Videos Page

Figure 4 the videos page contains a match summary and its organized according to the rounds.

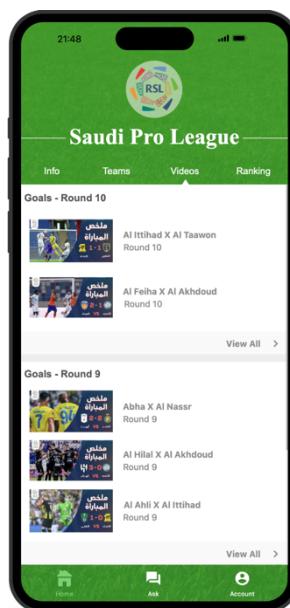


Figure 5: Videos Page.

3.2.5 Ranking Page

Figure 5 the Ranking page contains information about the players and the teams.

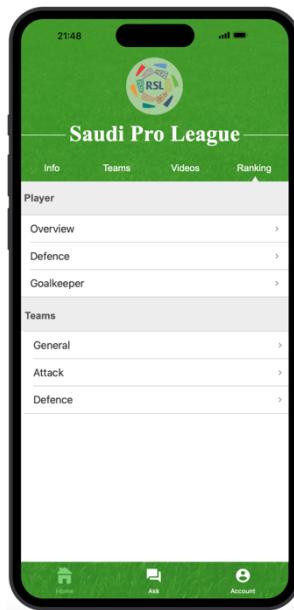


Figure 6: Ranking Page.

3.2.5.1 Overview

Figure 6 the overview page contains an overview about the players such as the goals, assist, passes, ...etc.

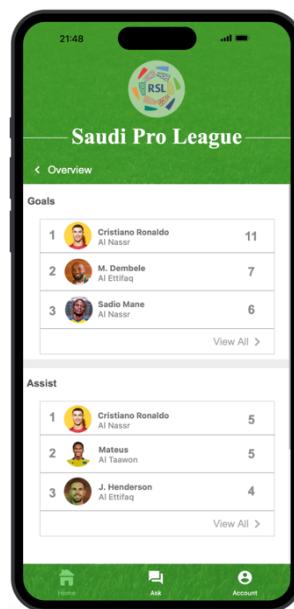


Figure 7: Overview.

3.2.5.2 General

Figure 7 the general page contains a general information about the teams such as the goals each team score, points, and ball possession, ...etc.

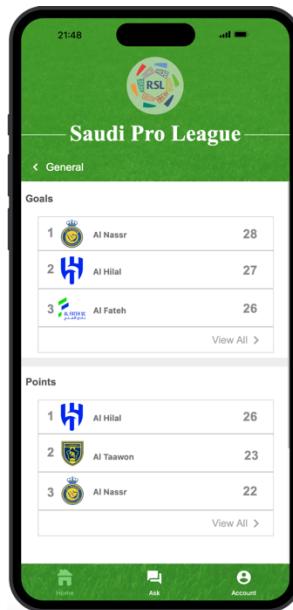


Figure 8: General.

3.2.6 Ask me

In the ask me page, the user can ask the expert system the interesting questions that he interested in, such as what the distinctive formation is, the best player in specific team and what can I do to improve my team. In the other hand, the expert system takes the questions and start to analyze it in the knowledge base and then responds to the user. As shown in **figure 8**.



Figure 9: Ask me.

3.3 System Component

Input:

The user will ask about the team he\she is interested in.

Process:

Expert systems take the name of a team, search it in a knowledge-based data system to verify its validity, and then collect and analyze its data.

Outputs:

Expert systems display the best lineups based on historical player data, predict match results, and display data and analysis related to the team the user selects.

3.4 System Flowchart

This flow chart shows how the system progresses from displaying the user's selected team to displaying the results, predictions, and related analyses based on their choice.

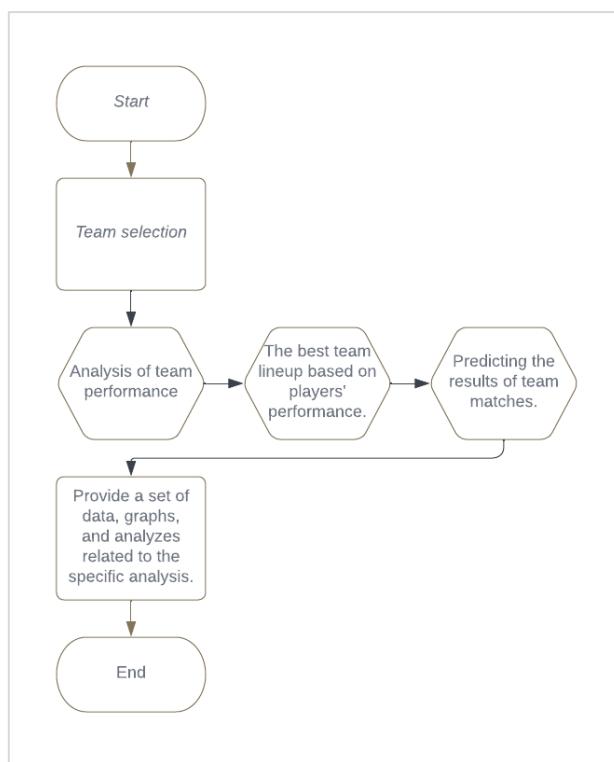


Figure 10: System Flowchart.

3.5 Data

The dataset for this project will comprise match data from the Saudi Professional League (SPL) for the current season (2023-2024). This dataset will encompass extensive information about all matches played during this period, including details on teams, matches, and players. The data will be sourced from the official SPL website (<https://www.spl.com.sa/en>) [6].

The collected data will serve as the foundation for training and evaluating machine learning models. These models will be instrumental in developing an application that delivers real-time insights and predictions regarding the SPL.

The application will provide users with various options to explore different aspects of the league:

Teams: users can view information about:

1-Team with the most points

2-Team with the most goals scored

3-Team with the fewest goals conceded

4-Team with the most wins

5-Team with the fewest losses

6-Team with the most draws

Matches: users can view information about:

1-Match with the most goals scored

2-Match with the fewest goals conceded

Players: users can view information about:

1-Player with the most goals scored

2-Player with the most assists

3-Player with the most yellow cards

4-Player with the most red cards

Users can exit the application by selecting option 0 at any point.

3.6 Tools

The proposed knowledge representation will be implemented using the Prolog programming language and the SWI-Prolog development environment.

Prolog:

Prolog is a logic programming language that is well-suited for developing rule-based systems. It is a powerful and expressive language that can be used to represent a wide variety of knowledge, including facts, rules, and relationships. Prolog is also a relatively easy language to learn, making it a good choice for this project.

SWI-Prolog:

SWI-Prolog is a popular Prolog implementation that is known for its stability, performance, and extensive library. It is a free and open-source implementation that is available for a variety of platforms, including Windows, and macOS.

In addition to Prolog and SWI-Prolog, the project will also make use of a variety of data sources as mentioned in the data section.

These tools will provide the project team with the necessary resources to develop a high-quality Prolog application that meets the needs of the Saudi Professional League. Specifically, they will:

- Enable the development of a powerful and expressive knowledge representation system.
- Facilitate the implementation of rule-based reasoning mechanisms.
- Provide access to a comprehensive library of Prolog modules.
- Ensure compatibility with a wide range of platforms.

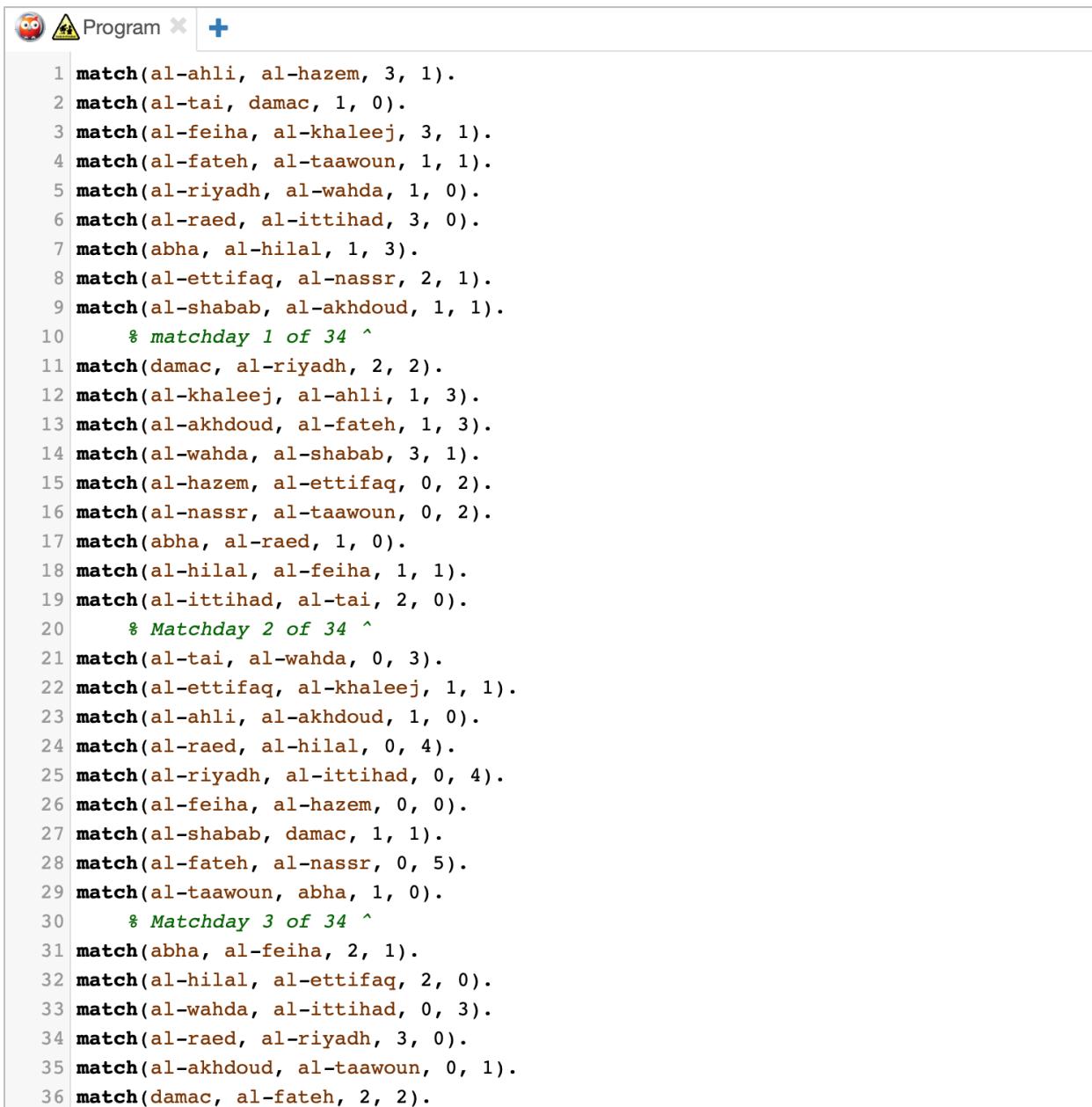
the use of Prolog and SWI-Prolog will provide the project with a solid foundation for developing a successful knowledge representation and reasoning system for the Saudi Professional League.

3.7 Implementation

This expert system was meticulously crafted using Swish Prolog, which enabled it to be effortlessly scrutinized, comprehended, and ultimately employed to render sound judgments. This was achieved through the inherent nature of Prolog, which assimilates facts and rules as a knowledge base, along with patient-formulated queries, which are subsequently scrutinized in light of previously established facts and rules.

3.7.1 Facts

Our system uses all of these facts, as shown in Figure 1.



The screenshot shows a Prolog IDE interface with a tab labeled "Program". The code area contains 36 numbered facts, each consisting of a predicate name followed by its arguments. The predicates are all named "match" followed by two team names and their scores. The scores range from 0 to 3. Some facts include comments indicating specific matchdays. The code is color-coded, with predicates in blue, atoms in black, and numbers in green.

```
1 match(al-ahli, al-hazem, 3, 1).
2 match(al-tai, damac, 1, 0).
3 match(al-feiha, al-khaleej, 3, 1).
4 match(al-fateh, al-taawoun, 1, 1).
5 match(al-riyadh, al-wahda, 1, 0).
6 match(al-raed, al-ittihad, 3, 0).
7 match(abha, al-hilal, 1, 3).
8 match(al-ettifaq, al-nassr, 2, 1).
9 match(al-shabab, al-akhdoud, 1, 1).
10 % matchday 1 of 34 ^
11 match(damac, al-riyadh, 2, 2).
12 match(al-khaleej, al-ahli, 1, 3).
13 match(al-akhdoud, al-fateh, 1, 3).
14 match(al-wahda, al-shabab, 3, 1).
15 match(al-hazem, al-ettifaq, 0, 2).
16 match(al-nassr, al-taawoun, 0, 2).
17 match(abha, al-raed, 1, 0).
18 match(al-hilal, al-feiha, 1, 1).
19 match(al-ittihad, al-tai, 2, 0).
20 % Matchday 2 of 34 ^
21 match(al-tai, al-wahda, 0, 3).
22 match(al-ettifaq, al-khaleej, 1, 1).
23 match(al-ahli, al-akhdoud, 1, 0).
24 match(al-raed, al-hilal, 0, 4).
25 match(al-riyadh, al-ittihad, 0, 4).
26 match(al-feiha, al-hazem, 0, 0).
27 match(al-shabab, damac, 1, 1).
28 match(al-fateh, al-nassr, 0, 5).
29 match(al-taawoun, abha, 1, 0).
30 % Matchday 3 of 34 ^
31 match(abha, al-feiha, 2, 1).
32 match(al-hilal, al-ettifaq, 2, 0).
33 match(al-wahda, al-ittihad, 0, 3).
34 match(al-raed, al-riyadh, 3, 0).
35 match(al-akhdoud, al-taawoun, 0, 1).
36 match(damac, al-fateh, 2, 2).
```

Figure 11: Facts.

```

37 match(al-nassr, al-shabab, 4, 0).
38 match(al-khaleej, al-hazem, 1, 1).
39 match(al-ahli, al-tai, 2, 0).
40     % Matchday 4 of 34 ^
41 match(al-feiha, al-raed, 0, 0).
42 match(al-tai, abha, 1, 0).
43 match(al-hilal, al-ittihad, 4, 3).
44 match(al-akhoud, al-riyadh, 1, 0).
45 match(al-hazem, al-nassr, 1, 5).
46 match(al-ahli, al-fateh, 1, 5).
47 match(al-ettifaq, damac, 3, 1).
48 match(al-shabab, al-khaleej, 1, 3).
49 match(al-taawoun, al-wahda, 4, 1).
50 % Matchday 5 of 34 ^
51 match(al-akhoud, al-ittihad, 0, 1).
52 match(al-wahda, damac, 4, 2).
53 match(al-feiha, al-shabab, 0, 1).
54 match(al-hilal, al-riyadh, 6, 1).
55 match(al-khaleej, al-fateh, 1, 3).
56 match(abha, al-ettifaq, 1, 3).
57 match(al-hazem, al-tai, 1, 1).
58 match(al-raed, al-nassr, 1, 3).
59 match(al-taawoun, al-ahli, 2, 3).
60 % Matchday 6 of 34 ^
61 match(al-ettifaq, al-tai, 4, 3).
62 match(al-taawoun, al-raed, 2, 1).
63 match(damac, al-hilal, 1, 1).
64 match(al-shabab, al-hazem, 4, 1).
65 match(al-ittihad, al-fateh, 2, 1).
66 match(al-riyadh, al-feiha, 1, 3).
67 match(al-akhoud, al-khaleej, 0, 1).
68 match(al-wahda, abha, 4, 0).
69 match(al-nassr, al-ahli, 4, 3).
70 % Matchday 7 of 34 ^
71 match(al-hazem, al-taawoun, 1, 3).

```

Figure 12: Facts.

```

72 match(al-tai, al-nassr, 1, 2).
73 match(al-feiha, al-ittihad, 0, 0).
74 match(al-hilal, al-shabab, 2, 0).
75 match(abha, al-riyadh, 0, 1).
76 match(al-raed, al-akhdoud, 1, 2).
77 match(al-fateh, al-wahda, 5, 1).
78 match(al-ahli, al-ettifaq, 0, 0).
79 match(al-khaleej, damac, 0, 2).
80 % Matchday 8 of 34 ^
81 match(damac, al-hazem, 4, 1).
82 match(al-riyadh, alshabab, 2, 2).
83 match(al-taawoun, al-tai, 3, 0).
84 match(al-ettifaq, al-fateh, 1, 2).
85 match(al-nassr, abha, 2, 2).
86 match(al-ittihad, al-ahli, 0, 1).
87 match(al-akhdoud, al-hilal, 0, 3).
88 match(al-khaleej, al-raed, 0, 0).
89 match(al-wahda, al-feiha, 1, 1).
90 % Matchday 9 of 34 ^
91 match(al-taawoun, al-ittihad, 1, 1).
92 match(al-akhdoud, al-feiha, 1, 2).
93 match(al-fateh, abha, 4, 1).
94 match(al-hilal, al-khaleej, 1, 0).
95 match(al-nassr, damac, 2, 1).
96 match(al-hazem, al-raed, 4, 3).
97 match(al-shabab, al-tai, 2, 0).
98 match(al-ahli, al-wahda, 3, 1).
99 match(al-riyadh, al-ettifaq, 1, 0).
100 % Matchday 10 of 34 ^
101 match(al-khaleej, al-taawoun, 1, 1).
102 match(al-akhdoud, damac, 0, 2).
103 match(al-ittihad, al-hazem, 2, 2).
104 match(al-raed, al-fateh, 1, 2).
105 match(al-tai, al-riyadh, 3, 2).
106 match(al-hilal, al-ahli, 3, 1).

```

Figure 13: Facts.

```

107 match(abha, al-shabab, 2, 1).
108 match(al-feiha, al-nassr, 3, 1).
109 match(al-wahda, al-ettifaq, 2, 3).
110     % Matchday 11 of 34 ^
111 match(al-fateh, al-hilal, 0, 2).
112 match(al-tai, al-feiha, 3, 3).
113 match(al-ittihad, al-shabab, 0, 1).
114 match(abha, al-akhoud, 3, 2).
115 match(al-khaleej, al-nassr, 0, 2).
116 match(al-raed, al-ettifaq, 0, 0).
117 match(al-hazem, al-wahda, 1, 2).
118 match(al-taawoun, damac, 0, 0).
119 match(al-riyadh, al-ahli, 0, 3).
120     % Matchday 12 of 34 ^
121 match(al-raed, al-shabab, 2, 1).
122 match(al-khaleej, al-tai, 3, 1).
123 match(damac, al-ahli, 2, 2).
124 match(al-fateh, al-riyadh, 1, 1).
125 match(al-hilal, al-taawoun, 2, 0).
126 match(abha, al-ittihad, 4, 2).
127 match(al-hazem, al-akhoud, 1, 2).
128 match(al-wahda, al-nassr, 1, 3).
129 match(al-feiha, al-ettifaq, 0, 0).
130     % Matchday 13 of 34 ^
131 match(al-taawoun, al-riyadh, 1, 2).
132 match(al-ettifaq, al-ittihad, 1, 1).
133 match(al-nassr, al-akhoud, 3, 0).
134 match(al-tai, al-raed, 4, 3).
135 match(al-hazem, al-hilal, 0, 9).
136 match(abha, damac, 4, 2).
137 match(al-wahda, al-khaleej, 3, 1).
138 match(al-ahli, al-shabab, 0, 0).
139 match(al-fateh, al-feiha, 2, 3).
140     % Matchday 14 of 34 ^
141 match(al-riyadh, al-hazem, 0, 1).

```

Figure 14: Facts.

```

142 match(abha, al-ahli, 0, 6).
143 match(al-itthiad, al-khaleej, 4, 2).
144 match(al-hilal, al-nassr, 3, 0).
145     & Matchday 15 of 34 ^
146
147
148 assist('Riyad Mahrez', 'Al Ahli Jeddah', 7).
149 assist('Cristiano Ronaldo', 'Al Nassr FC Riyadh', 7).
150 assist('Mourad Batna', 'Al Fateh', 7).
151 assist('Alvaro Medran', 'Al Taawoun', 6).
152 assist('Faycal Fajr', 'Al Wehda Mecca', 5).
153 assist('Igor Coronado', 'Ittihad Jeddah', 5).
154 assist('Abdulrahman Ghareeb', 'Al Nassr FC Riyadh', 5).
155 assist('Abdulaziz Noor', 'Al Wehda Mecca', 5).
156 assist('Jordan Henderson', 'Al Ettifaq', 4).
157 assist('Karim Benzema', 'Ittihad Jeddah', 4).
158 assist('Sergej Milinkovic-Savic', 'Al Hilal Riyadh', 4).
159 assist('Yannick Carrasco', 'Al Shabab Riyadh', 4).
160 assist('Georges Nkoudou', 'Dhamk', 4).
161 assist('Allan Saint-Maximin', 'Al Ahli Jeddah', 4).
162 assist('Malcom', 'Al Hilal Riyadh', 4).
163 assist('Lucas Zelarayan', 'Al Fateh', 4).
164 assist('Toze', 'Al Hazm', 4).
165 assist('Nicolae Stanciu', 'Dhamk', 4).
166 assist('Sultan Al Ghanam', 'Al Nassr FC Riyadh', 4).
167 assist('Firas Al-Braikan', 'Al Ahli Jeddah', 4).
168
169
170 yellowCard('Abdulbasit Hindi', 'Al Ahli Jeddah', 7).
171 yellowCard('Florin Tanase', 'Al-Akhoud', 6).
172 yellowCard('Roger Ibanez', 'Al Ahli Jeddah', 6).
173 yellowCard('Iago Santos', 'Al Shabab Riyadh', 5).
174 yellowCard('Ivo Rodrigues', 'Al Khaleej Club', 5).
175 yellowCard('Tarek Hamed', 'Dhamk', 5).
176 yellowCard('Jordan Henderson', 'Al Ettifaq', 4).

```

Figure 15: Facts.

```

177 yellowCard('Waleed Bakshween', 'Al Wehda Mecca', 4).
178 yellowCard('Ruben Neves', 'Al Hilal Riyadh', 4).
179 yellowCard('Fabio Martins', 'Al Khaleej Club', 4).
180 yellowCard('Gustavo Cuellar', 'Al Shabab Riyadh', 4).
181 yellowCard('Romain Saiss', 'Al Shabab Riyadh', 4).
182 yellowCard('Flavio', 'Al Taawoun', 4).
183 yellowCard('Hamad Al Jayzani', 'Al Raed', 4).
184 yellowCard('Ali Al-Bulaihi', 'Al Hilal Riyadh', 4).
185 yellowCard('Abdullah Alkhaibari', 'Al Nassr FC Riyadh', 4).
186 yellowCard('Woo-Young Jung', 'Al Khaleej Club', 4).
187 yellowCard('Mansor Al Beshe', 'Al Raed', 4).
188 yellowCard('Mohammed Al Doseri', 'Al Raed', 4).
189 yellowCard('Aloyayari Abdulmalik', 'Al Taawoun', 4).
190
191 redCard('Ever Banega', 'Al Shabab Riyadh', 1).
192 redCard('Sergej Milinkovic-Savic', 'Al Hilal Riyadh', 1).
193 redCard('Hamed Al Mansour', 'Al-Akhoud', 1).
194 redCard('Khaled Narey', 'Al Khaleej Club', 1).
195 redCard('Iago Santos', 'Al Shabab Riyadh', 1).
196 redCard('Alvaro Medran', 'Al Taawoun', 1).
197 redCard('Ahmad Al Hbeab', 'Abha Club', 1).
198 redCard('Marwane Saadane', 'Al Fateh', 1).
199 redCard('Bruno Viana', 'Al Hazm', 1).
200 redCard('Sultan Al Ghanam', 'Al Nassr FC Riyadh', 1).
201 redCard('Saeed Alyami', 'Al-Akhoud', 1).
202 redCard('Alaa Hejji', 'Al Wehda Mecca', 1).
203 redCard('Ali Al-Bulaihi', 'Al Hilal Riyadh', 1).
204 redCard('Mukhtar Ali', 'Al Fateh', 1).
205 redCard('Alfa Semedo', 'Al Ta i', 1).
206 redCard('Abdelfatah Adam', 'Al Taawoun', 1).
207 redCard('Merih Demiral', 'Al Ahli Jeddah', 1).
208 redCard('Abdulbasit Hindi', 'Al Ahli Jeddah', 1).
209 redCard('Alex Collado', 'Al-Akhoud', 1).
210 redCard('Mansor Al Beshe', 'Al Raed', 1).

```

Figure 16: Facts.

```

213 goals('Cristiano Ronaldo', 'Al Nassr FC Riyadh', 15).
214 goals('Aleksandar Mitrovic', 'Al Hilal Riyadh', 13).
215 goals('Georges NKoudou', 'Dhamk', 11).
216 goals('Karim Benzema', 'Ittihad Jeddah', 9).
217 goals('Malcom', 'Al Hilal Riyadh', 9).
218 goals('Bernard Mensah', 'Al Ta i', 8).
219 goals('Odion Ighalo', 'Al Wehda Mecca', 8).
220 goals('Firas Al-Braikan', 'Al Ahli Jeddah', 8).
221 goals('Anderson Talisca', 'Al Nassr FC Riyadh', 8).
222 goals('Abderrazak Hamdallah', 'Ittihad Jeddah', 7).
223 goals('Salem Al Dawsari', 'Al Hilal Riyadh', 7).
224 goals('Mourad Batna', 'Al Fathe', 7).
225 goals('Moussa Demb茅', 'Al Ettifaq', 7).
226 goals('Fabio Martins', 'Al Khaleej Club', 6).
227 goals('Riyad Mahrez', 'Al Ahli Jeddah', 6).
228 goals('Cristian Tello', 'Al Fathe', 6).
229 goals('Assan Ceesay', 'Dhamk', 6).
230 goals('Fashion Sakala', 'Al Feiha', 6).
231 goals('Sadio Man茅', 'Al Nassr FC Riyadh', 6).
232 goals('Saleh Al Abbas', 'Al Riyadh SC', 6).

233
234
235 team(al-hilal).
236 team(al-nassr).
237 team(al-ahli).
238 team(al-ittihad).
239 team(al-taawoun).
240 team(al-fateh).
241 team(al-ettifaq).
242 team(al-feiha).
243 team(al-wadha).
244 team(damac).
245 team(al-shabab).
246 team(al-riyadh).
247 team(al-tai).

```

Figure 18: Facts.

```

248 team(al-khaleej).
249 team(abha).
250 team(al-akhoud).
251 team(al-raed).
252 team(al-hazem).
253

```

Figure 19: Facts.

The facts here represent Saudi league matches, players, goals, and teams. Based on the user's choice in the system, they will be guided through a comprehensive journey of the league, exploring its teams and matching results and points. This interactive experience transforms the user from a casual observer into an informed aficionado equipped with a deep understanding of the league.

3.7.2 Code

The Saudi Professional League Analysts' data and source codes are included in the Appendix.

3.7.2.1 Start Rule

The 'Saudi Professional League Analysts' Rule is shown in figure 2, and represents the statement used as a starting point.

```
477 display_top_menu :-  
478     nl,  
479     write('⚽⚽⚽    Saudi Professional League Analyst    ⚽⚽⚽'), nl, nl,  
480     write('Hello! I am the Analysts of the Saudi Pro League SPL'), nl,  
481     write('And I am here to help you know what is going on the League'), nl,  
482     write('|| Please choose what you want to know from the menu ||'), nl, nl,  
483     forall(top_menu_option(Index, Option),  
484         (write(Index), write('.'), write(Option), nl)),  
485     nl.
```

Figure 20: Start Rule .

3.7.2.2 Team

3.7.2.2.1 List of Teams

The rule shown in figure 3 generates a list of all teams from the knowledge base and stores it in the variable TeamsList.

```
259 % List of teams  
260 list_of_teams(TeamsList):-          % to generate the entire list of teams.  
261     findall(X,team(X),TeamsList). % the body of the predicate,
```

Figure 21: List of teams .

3.7.2.2 Team with the most points

The Team_points rule, shown in figure 4, identifies the team in a league with the highest points. It retrieves a list of all teams using the list_of_teams rule and then calculates each team's points using the points_team rule. Using the count_points rule, points are tallied according to the goal difference.

```
263 % The team with the most points
264 team_points(T):- 
265   list_of_teams(Teams),
266   points_team(Teams,Points),
267   max_member(MaxPoints, Points), % Get the maximum points
268   nth1(Index, Points, MaxPoints), % Get the index of the maximum points
269   nth1(Index, Teams, T),!. % Retrieve the team at that index
270 
271 points_team([],[]).
272 points_team([X|T],[Points|Rest]) :-
273   findall((X,G1,G2),(match(X,_,G1,G2);match(_,X,G2,G1)),L),
274   count_points(L,Points),
275   points_team(T,Rest).
276 
277 count_points([], 0):-!.
278 count_points([(_,G1,G2)|Results], Points) :-
279   G is G1 - G2,
280   (G < 0 -> PointsRest = 1; G > 0 -> PointsRest = 3; PointsRest = 0),
281   count_points(Results, Rest),
282   Points is PointsRest + Rest.
283 
```

Figure 22: Teams with the most points .

3.7.2.2.3 Team with the most goals

The team_goals rule, shown in figure 5, identifies the team with the most goals in a league. First, the list_of_teams rule retrieves the list of all the teams. Next, it calculates the total goals scored by each team using the goals_team rule. Each team's total goals are meticulously accumulated using the count_goal rule. Finally, the team with the highest goal count was determined.

```
285  % The team with the most goals
286  team_goals(T):-%
287      list_of_teams(Teams),
288      goals_team(Teams,Goals),
289      max_member(MaxGoals, Goals), % Get the maximum goals
290      nth1(Index, Goals, MaxGoals), % Get the index of the maximum goals
291      nth1(Index, Teams, T),!. % Retrieve the team at that index
292
293  goals_team([],[]). % handles the case where the input list of teams is empty
294  goals_team([X|T],[Goals|Rest]):-
295      findall((X,G1),(match(X,_,G1,_);match(_,X,_,G1)),L),
296      count_goals(L,Goals),
297      goals_team(T,Rest).
298
299  count_goals([], 0):-!.
300  count_goals([(_,G1)|Results], Goals) :-
301      count_goals(Results, Rest),
302      Goals is G1 + Rest.
```

Figure 23: Teams with the most goals .

3.7.2.2.4 Team conceded the least goals

The team_conceded_goals rule, as shown in figure 6, identifies the team that has conceded the fewest goals. First, the list_of_teams rule retrieves a comprehensive list of all the participating teams. Next, the conceded_goals rule meticulously calculates the number of goals that each team conceded. Count_goals diligently accumulated the total number of goals conceded by each team.

```
304  % The team conceded the least goals
305  team_conceded_goals(T):- 
306      list_of_teams(Teams),
307      conceded_goals(Teams,Goals),
308      min_list(Goals, MinGoals), % Get the minimum value in Goals
309      nth1(Index, Goals, MinGoals), % Get the index of the minimum value
310      nth1(Index, Teams, T),!. % Retrieve the team at that index
311
312  conceded_goals([],[]).
313  conceded_goals([X|T],[Goals|Rest]):-
314      findall(Goal, (match(X, _, _, Goal); match(_, X, Goal, _)), GoalsList),
315      sum_list(GoalsList, Goals),
316      conceded_goals(T,Rest).
```

Figure 24: Teams conceded the least goals .

3.7.2.2.5 Team who won the most

In figure 7, the team with the most wins is identified using the team_won rule. A comprehensive list of all participating teams was meticulously compiled using the list_of_teams rule. In the next step, the wins rule meticulously calculates the number of victories achieved by each team. In Count_wins, each team's total wins are accumulated meticulously.

```
319  % Most team won
320  team_won(T):-
321      list_of_teams(Teams),
322      wins(Teams,Wins),
323      max_member(MaxWins, Wins), % Get the maximum wins
324      nth1(Index, Wins, MaxWins), % Get the index of the maximum wins
325      nth1(Index, Teams, T),!. % Retrieve the team at that index
326
327  wins([],[]).
328  wins([X|T],[Wins|Rest]):-
329      findall((X,G1,G2),(match(X,_,G1,G2);match(_,X,G2,G1)),L),
330      count_wins(L,Wins),
331      wins(T,Rest).
332
333  count_wins([], 0):-!.
334  count_wins([(_,G1,G2)|Results], Wins) :-
335      G is G1 - G2,
336      (G <= 0 -> WinsRest = 0; WinsRest = 1),
337      count_wins(Results, Rest),
338      Wins is WinsRest + Rest.
```

Figure 25: Teams who won the most .

3.7.2.2.6 Team that lost the least.

Figure 8 shows the team with the greatest losses throughout the league, using the team_lost rule. At the beginning of the list_of_teams rule, an exhaustive list of all participating teams was meticulously retrieved. Next, the loss rule calculates the loss incurred by each team. In Count_losses, the total losses of each team are accumulated meticulously.

```
340  * The team that lost the least
341  team_lost(T):- 
342      list_of_teams(Teams),
343      losses(Teams,Losses),
344      min_member(MinLosses, Losses), * Get the minimum losses
345      nth1(Index, Losses, MinLosses), * Get the index of the minimum losses
346      nth1(Index, Teams, T),!. * Retrieve the team at that index
347
348  losses([],[]).
349  losses([X|T],[Losses|Rest]):-
350      findall((X,G1,G2),(match(X,_,G1,G2);match(_,X,G2,G1)),L),
351      count_losses(L,Losses),
352      losses(T,Rest).
353
354  count_losses([], 0):-!.
355  count_losses([(_,G1,G2)|Results], Losses) :-
356      G is G1 - G2,
357      (G <= 0 -> LossesRest = 1; LossesRest = 0),
358      count_losses(Results, Rest),
359      Losses is LossesRest + Rest.
```

Figure 26: Teams that lost the least .

3.7.2.2.7 Most draw team

Based on the team_draw rule, figure 9 highlights the teams with the most draws throughout the league. Initially, the list_of_teams rule retrieved a comprehensive list of all participating teams. Next, each team's draw count was calculated meticulously using the draw rule. The total number of draws for each team was calculated using Count_draws.

```
361  * Most draw team
362  team_draw(T):-
363      list_of_teams(Teams),
364      draws(Teams,Draws),
365      max_member(MaxDraws, Draws), * Get the maximum draws
366      nth1(Index, Draws, MaxDraws), * Get the index of the maximum draws
367      nth1(Index, Teams, T),!. * Retrieve the team at that index
368
369  draws([],[]).
370  draws([X|T],[Draws|Rest]):-
371      findall((X,G1,G2),(match(X,_,G1,G2);match(_,X,G2,G1)),L),
372      count_draws(L,Draws),
373      draws(T,Rest).
```

Figure 27: Most draw team .

3.7.2.3 Matches

3.7.2.3.1 List of matches

The first rule shown in figure is list_of_matches(M) this predicate takes a list M as output and returns all the matches that have been played. It uses the findall to collect all of the matches from the match facts. Also the print_match((X,Y:G1-G2)) rule, This predicate takes a match as input and prints it to the console.

```
%% MATCHES
%%%%%
%List of matches
list_of_matches(M):-  
    findall((X,Y:G1-G2),match(X,Y,G1,G2),M).  
  
print_match((X,Y:G1-G2)):-  
    format("~W ~W - ~W ~W",[X,G1,G2,Y]).
```

Figure 28: List of matches .

3.7.2.3.2 Match that conceded the most goals

The most_goal_match rule, shown in figure, identifies the match with the most goals scored. It does this by first getting a list of all matches, then calculating the total number of goals scored for each match, then finding the match with the most goals scored, and finally returning that match.

```
%Most goals scored match
most_goal_match(M):-
    list_of_matches(Matches),
    most_goal(Matches,Goals),
    max_member(MaxGoals, Goals), % Get the maximum goals
    nth1(Index, Goals, MaxGoals), % Get the index of the maximum goals
    nth1(Index, Matches, M),!. % Retrieve the match at that index

most_goal([],[]).
most_goal([(,_:_G1-G2)|T],[Goals|Rest]):-
    Goals is G1+G2,
    most_goal(T,Rest).
```

Figure 29: Match that conceded the most goals .

3.7.2.3.3 Match that conceded the least goals

The min_goal_match rule, shown in figure identifies the match with the fewest goals conceded by first retrieving all matches and then calculating the total goals scored for each match. Next, it finds the minimum total goals and retrieves the corresponding match from the list of matches.

```
%The match that conceded the Least goals
min_goal_match(M):-
    list_of_matches(Matches),
    most_goal(Matches,Goals),
    min_member(MinGoals, Goals), % Get the minimum goals
    nth1(Index, Goals, MinGoals), % Get the index of the minimum goals
    nth1(Index, Matches, M),!. % Retrieve the match at that index
```

Figure 30: Match that conceded the least goals .

3.7.2.4 Player

3.7.2.4.1 Player who scored the most goals

This code is based on coaches' evaluations of player and team performance. It can be used to identify the top scorers in a season and to predict which players are likely to improve in the future.

```
*The player who scored the most goals
player_scored_most(Player) :-
    findall(goals(Name, Team, Goals), goals(Name, Team, Goals), GoalsList),
    player_with_most_goals(GoalsList, Player), !.

player_with_most_goals(GoalsList, (Player, Team, MaxGoals)) :-
    maplist(arg(3), GoalsList, GoalsOnly),
    max_list(GoalsOnly, MaxGoals),
    member(goals(Player, Team, MaxGoals), GoalsList).
```

Figure 31: Player who scored the most goals .

3.7.2.4.2 Player who made the most assists

This code is used to find the player who has made the most assists based on the knowledge base. This code was used to analyze our knowledge base data to determine the most productive providers. The code is based on the findall and max_list predicates, which are used to find all assists made by players to find the maximum number of assists, respectively.

```
*The player who made the most goals
player_made_most(Player) :-
    findall(assist(Name, Team, Assists), assist(Name, Team, Assists), AssistsList),
    player_with_most_assists(AssistsList, Player).

player_with_most_assists(AssistsList, (Player, Team, MaxAssists)) :-
    maplist(arg(3), AssistsList, AssistsOnly),
    max_list(AssistsOnly, MaxAssists),
    member(assist(Player, Team, MaxAssists), AssistsList).
```

Figure 32: Player who made the most assists .

3.7.2.4.3 Player who received the most yellow cards

To determine the player who received the largest number of yellow cards in a given data set, the code below was developed. This code is useful in analyzing football data and understanding disciplinary patterns among players. The code is based on the findall and max_list predicates, which were used to retrieve all yellow cards received by players and identify the player with the highest number of yellow cards, respectively.

```
% The player who received the most yellow cards
player_received_most_yellow_card(Player) :-
    findall(yellowCard(Name, Team, YellowCards), yellowCard(Name, Team, YellowCards), YellowCardsList),
    player_with_most_yellow_cards(YellowCardsList, Player).

player_with_most_yellow_cards(YellowCardsList, (Player, Team, MaxYellowCards)) :-
    maplist(arg(3), YellowCardsList, YellowCardsOnly),
    max_list(YellowCardsOnly, MaxYellowCards),
    member(yellowCard(Player, Team, MaxYellowCards), YellowCardsList).
```

Figure 33: Player who received the most yellow cards .

3.7.2.4.4 Player who received the most red cards

The code below is based on an important vision, which is to determine the player who received the largest number of red cards among players in the Saudi League. This code provides a unique addition to analyzing data on players with a history of aggressive behavior. The code is based on the findall and max_list predicates, which are used to retrieve all red cards received by all players and identify the player with the most red cards.

```
% The player who received the most red cards
player_received_most_red_card(Player) :-
    findall(redCard(Name, Team, RedCards), redCard(Name, Team, RedCards), RedCardsList),
    player_with_most_red_cards(RedCardsList, Player).

player_with_most_red_cards(RedCardsList, (Player, Team, MaxRedCards)) :-
    maplist(arg(3), RedCardsList, RedCardsOnly),
    max_list(RedCardsOnly, MaxRedCards),
    member(redCard(Player, Team, MaxRedCards), RedCardsList).
```

Figure 34: Player who received the most red cards .

Chapter 4: Results and Evaluation:

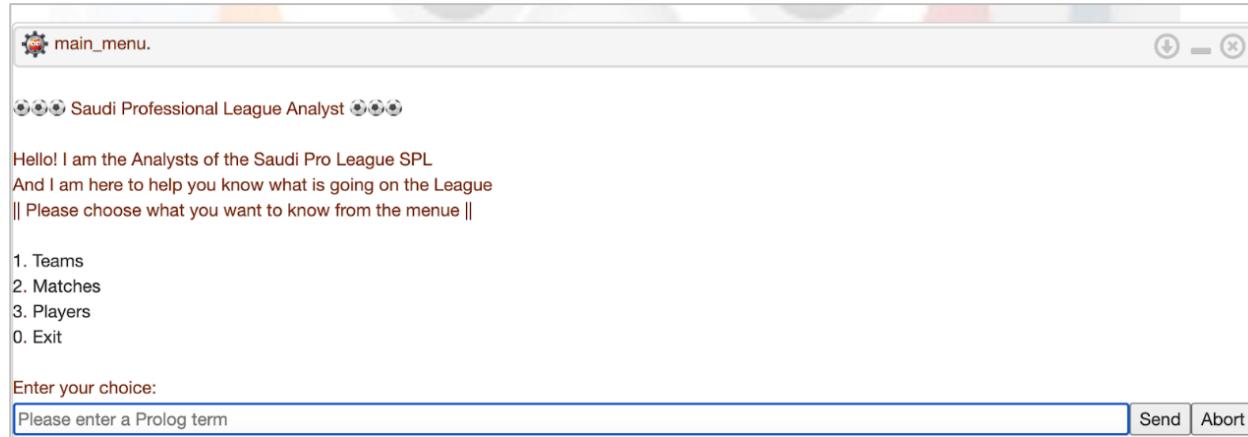


Figure 35: Main menu display.

This is the main view of the chatbot that the user can interact with by selecting one of the options shown.

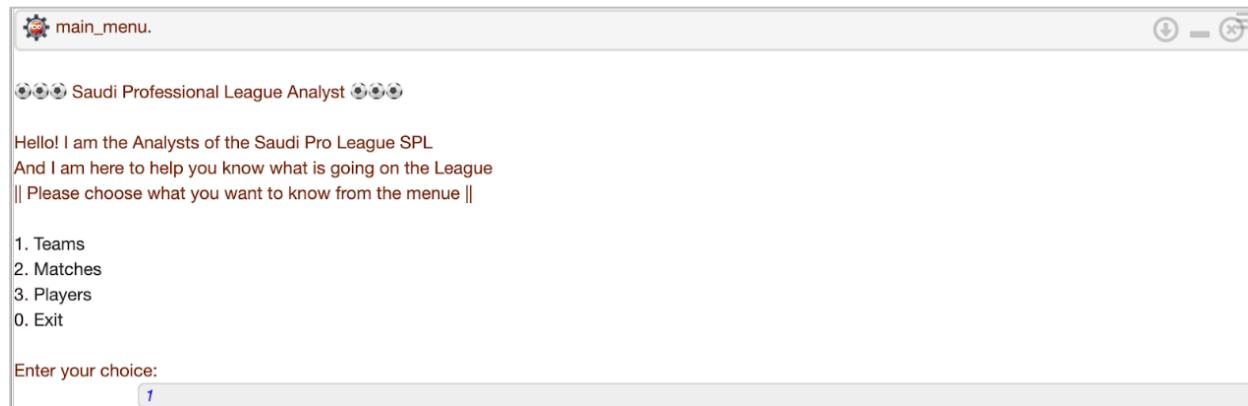


Figure 36: Select option #1 Teams.

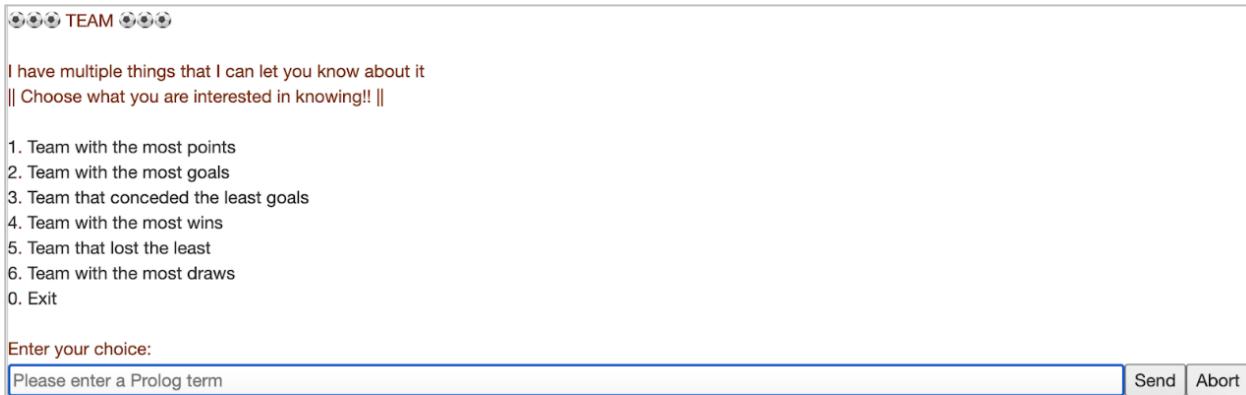


Figure 37: Menu display of the Teams option.

Once the user has selected "Team", the user can explore specific aspects of the teams' performance from the given options: 1- the team with the most points, 2- the most goals, 3- the fewest goals conceded, 4- the most wins, 5- the fewest losses, 6- the most draws and 0 to exit.

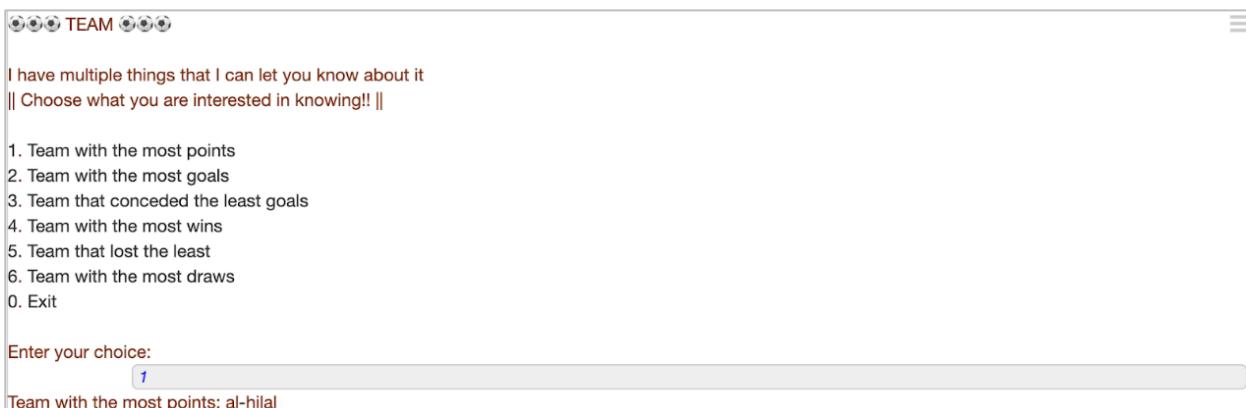


Figure 38: Select option #1: Team with the most point.

This option will reveal the team that has accumulated the highest number of points among the 18 participating teams.

TEAM

I have multiple things that I can let you know about it
|| Choose what you are interested in knowing!! ||

1. Team with the most points
2. Team with the most goals
3. Team that conceded the least goals
4. Team with the most wins
5. Team that lost the least
6. Team with the most draws
0. Exit

Enter your choice:

2

Team with the most goals: al-hilal

Figure 39: Select option #2: Team with the most goals.

This option will reveal the team that has accumulated the highest number of goals among the 18 participating teams.

TEAM

I have multiple things that I can let you know about it
|| Choose what you are interested in knowing!! ||

1. Team with the most points
2. Team with the most goals
3. Team that conceded the least goals
4. Team with the most wins
5. Team that lost the least
6. Team with the most draws
0. Exit

Enter your choice:

3

Team that conceded the least goals: al-wadha

Figure 40: Select option #3: Team that conceded the least goals.

This option will reveal the team that has accumulated the least number of goals among the 18 participating teams.

TEAM

I have multiple things that I can let you know about it
|| Choose what you are interested in knowing!! ||

1. Team with the most points
2. Team with the most goals
3. Team that conceded the least goals
4. Team with the most wins
5. Team that lost the least
6. Team with the most draws
0. Exit

Enter your choice:

4

Team with the most wins: al-hilal

Figure 41: Select option #4: Team with the most wins.

This option will reveal the team that has accumulated the most number of wins among the 18 participating teams.

TEAM

I have multiple things that I can let you know about it
|| Choose what you are interested in knowing!! ||

1. Team with the most points
2. Team with the most goals
3. Team that conceded the least goals
4. Team with the most wins
5. Team that lost the least
6. Team with the most draws
0. Exit

Enter your choice:

5

Team that lost the least: al-wadha

Figure 42: Select option #5: Team that lost the least.

This option will reveal the team that has lost the least among the 18 participating teams.

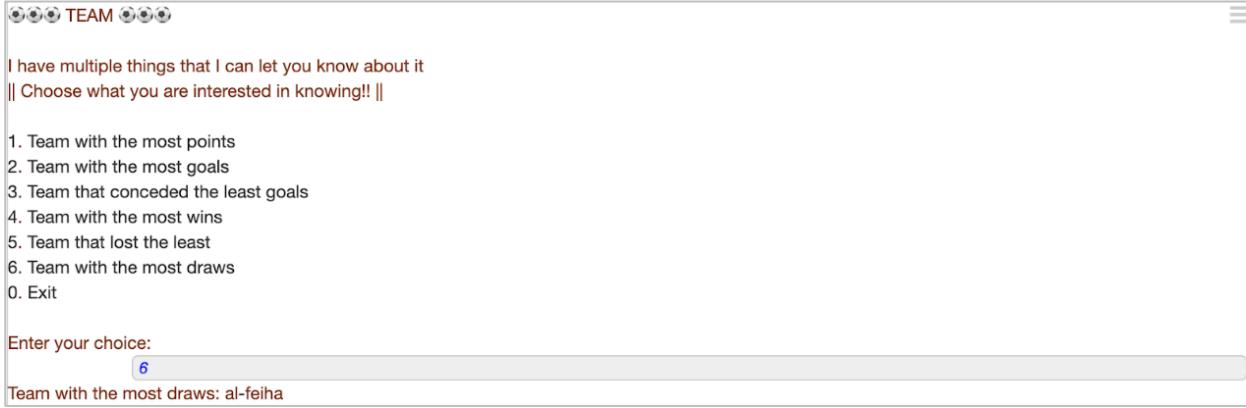


Figure 43: Select option #6: Team with the most draws.

This option will reveal the team that has accumulated the highest number of draws among the 18 participating teams.

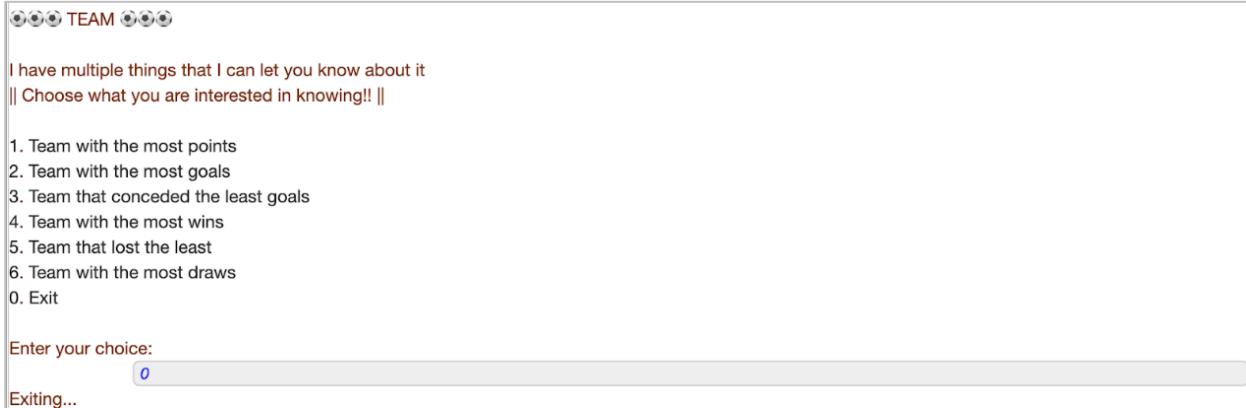


Figure 44: Select option #6: Team with the most draws.

This option will return the user to the main menu shown in **Figure #35**.

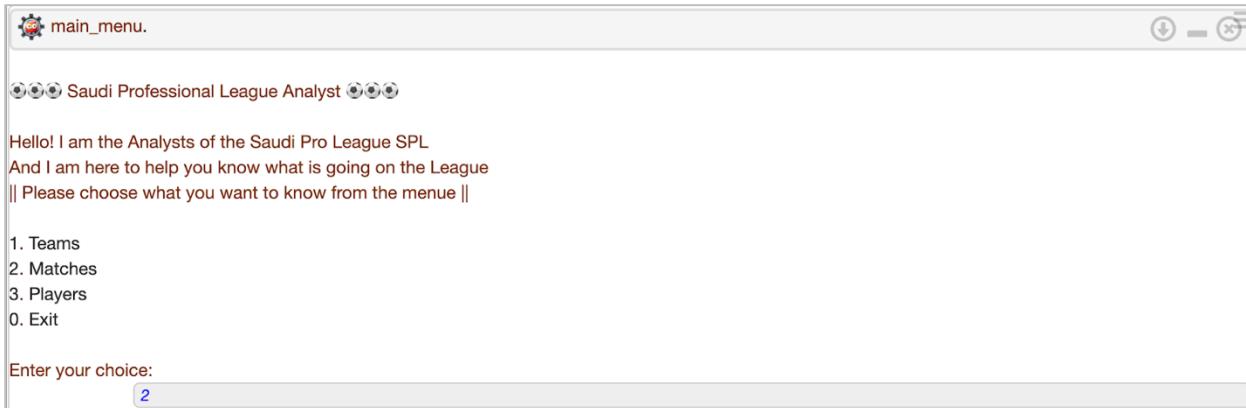


Figure 45: Select option #2 Matches.



Figure 46: Menu display of the Matches option.

Once the user has selected “Matches”, the user can explore specific aspects of the matches results from the given options: 1- Match with the most goals 2- Match that conceded the least goals and 0 to exit.



Figure 47: Select option #1: Match with the most goals.

This option will reveal the match that has accumulated the highest number of goals among the 130 matches.



Figure 48: Select option #2: Match that conceded the least goals.

This option will reveal the match that has accumulated the lowest number of goals among the 130 matches.

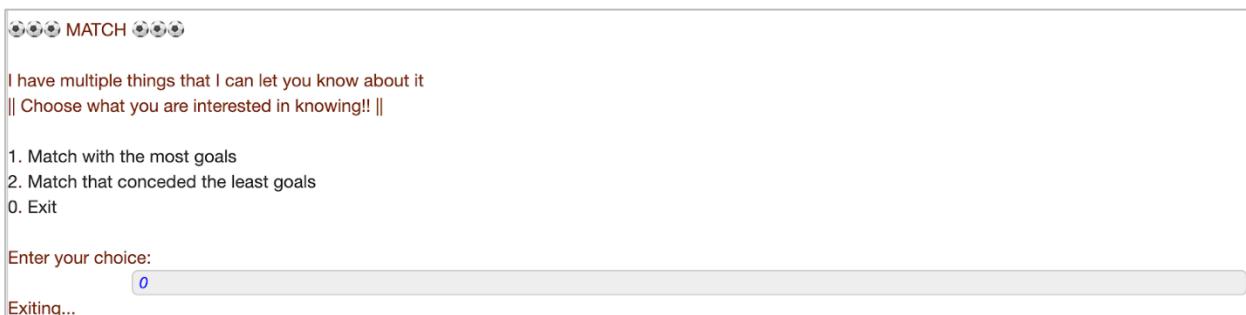


Figure 49: Select option #0: Exit.

This option will return the user to the main menu shown in **Figure #35**.



Figure 50: Select option #3 Players.

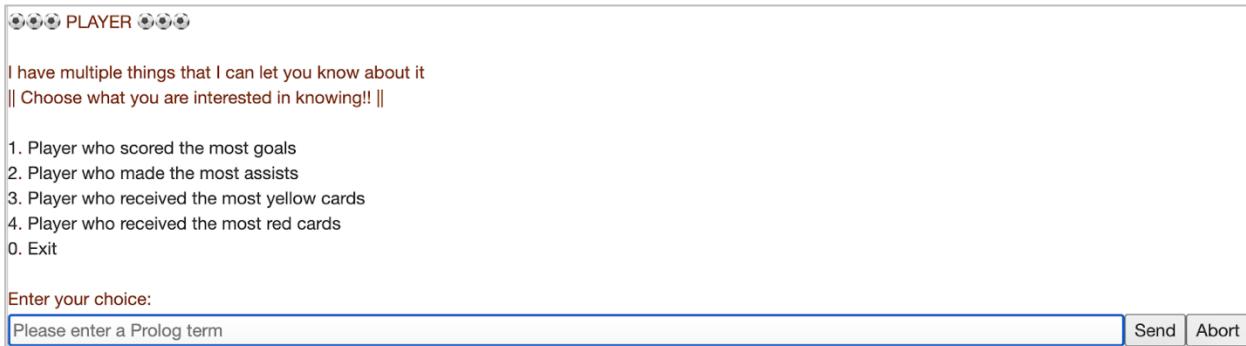


Figure 51: Menu display of the Players option.

Once the user has selected “Players”, the user can explore specific aspects of the players from the given options: 1- Player who scored the most goals 2- Player who made the most assists 3- Player who received the most yellow cards 4- Player who received the most red cards and 0 to exit.

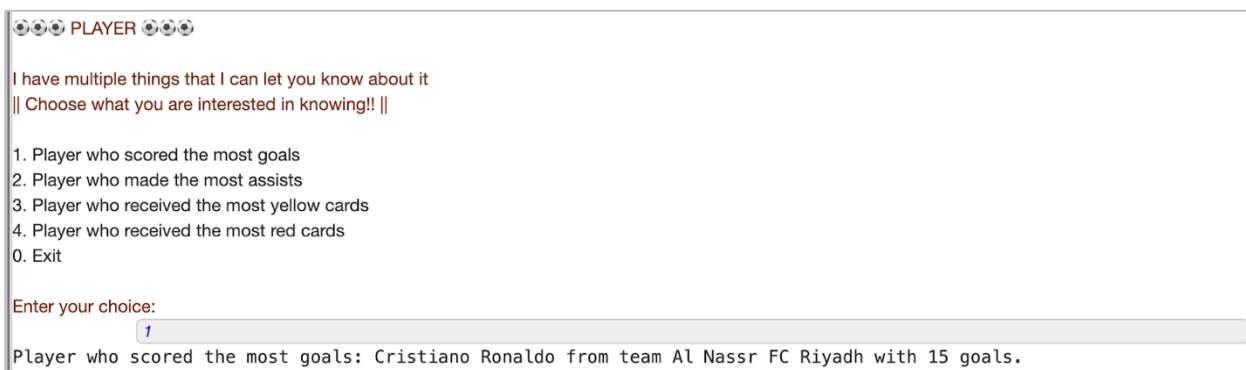


Figure 52: Select option #1: Player who scored the most goals.

This option will reveal the player that has accumulated the highest number of goals among the 130 matches.

●●● PLAYER ●●●

I have multiple things that I can let you know about it
|| Choose what you are interested in knowing!! ||

1. Player who scored the most goals
2. Player who made the most assists
3. Player who received the most yellow cards
4. Player who received the most red cards
0. Exit

Enter your choice:

2

Player who made the most assists: Riyad Mahrez from team Al Ahli Jeddah with 7 assists.
Player who made the most assists: Cristiano Ronaldo from team Al Nassr FC Riyadh with 7 assists.
Player who made the most assists: Mourad Batna from team Al Fateh with 7 assists.

Figure 53: Select option #2: Player who made the most assists.

This option will reveal the player that has accumulated the highest number of assists among the 130 matches.

●●● PLAYER ●●●

I have multiple things that I can let you know about it
|| Choose what you are interested in knowing!! ||

1. Player who scored the most goals
2. Player who made the most assists
3. Player who received the most yellow cards
4. Player who received the most red cards
0. Exit

Enter your choice:

3

Player who received the most yellow cards: Abdulbasit Hindi from team Al Ahli Jeddah with 7 yellow cards.

Figure 54: Select option #3: Players who received the most yellow cards.

This option will reveal the player that has received the highest number of yellow cards among the 130 matches.

PLAYER

I have multiple things that I can let you know about it
 || Choose what you are interested in knowing!! ||

1. Player who scored the most goals
2. Player who made the most assists
3. Player who received the most yellow cards
4. Player who received the most red cards
0. Exit

Enter your choice:

Figure 55: Select option #4: Players who received the most red cards.

Player who received the most red cards: Ever Banega from team Al Shabab Riyadh with 1 red cards.
 Player who received the most red cards: Sergej Milinkovic-Savic from team Al Hilal Riyadh with 1 red cards.
 Player who received the most red cards: Hamed Al Mansour from team Al-Akhoud with 1 red cards.
 Player who received the most red cards: Khaled Narey from team Al Khaleej Club with 1 red cards.
 Player who received the most red cards: Iago Santos from team Al Shabab Riyadh with 1 red cards.
 Player who received the most red cards: Alvaro Medran from team Al Taawoun with 1 red cards.
 Player who received the most red cards: Ahmad Al Hbeab from team Abha Club with 1 red cards.
 Player who received the most red cards: Marwane Saadane from team Al Fateh with 1 red cards.
 Player who received the most red cards: Bruno Viana from team Al Hazm with 1 red cards.
 Player who received the most red cards: Sultan Al Ghanam from team Al Nassr FC Riyadh with 1 red cards.
 Player who received the most red cards: Saeed Alyami from team Al-Akhoud with 1 red cards.
 Player who received the most red cards: Alaa Hejji from team Al Wehda Mecca with 1 red cards.
 Player who received the most red cards: Ali Al-Bulaihi from team Al Hilal Riyadh with 1 red cards.
 Player who received the most red cards: Mukhtar Ali from team Al Fateh with 1 red cards.
 Player who received the most red cards: Alfa Semedo from team Al Ta'i with 1 red cards.
 Player who received the most red cards: Abdelfatah Adam from team Al Taawoun with 1 red cards.
 Player who received the most red cards: Merih Demiral from team Al Ahli Jeddah with 1 red cards.
 Player who received the most red cards: Abdulbasit Hindi from team Al Ahli Jeddah with 1 red cards.
 Player who received the most red cards: Alex Collado from team Al-Akhoud with 1 red cards.
 Player who received the most red cards: Mansor Al Beshe from team Al Raed with 1 red cards.

Figure 56: Extension to the previous figure.

This option will reveal the player that has received the highest number of red cards among the 130 matches.

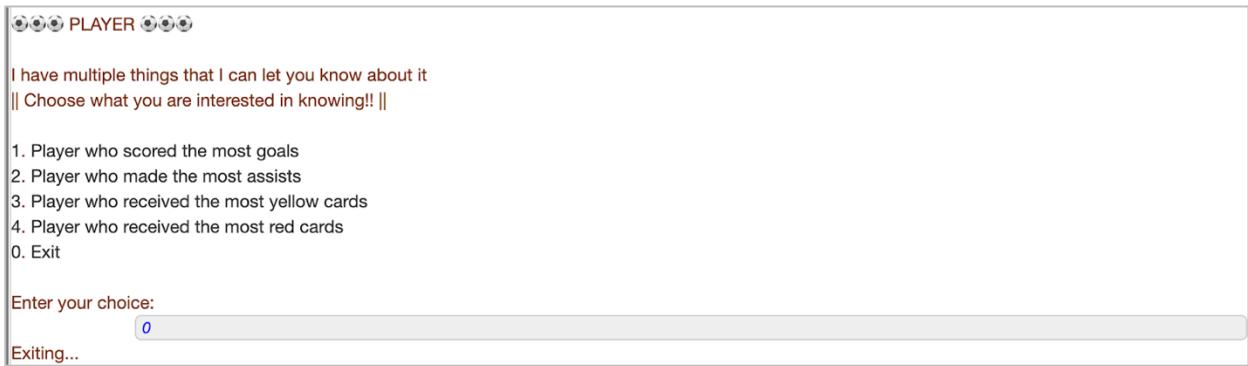


Figure 57: Select option #0: Exit.

This option will return the user to the main menu shown in **Figure #35**.

The system has been rigorously evaluated on a variety of devices to ensure its user-friendliness and efficiency. Based on these consistent results, the model is accurate and is capable of achieving both general and specific project objectives. Among the system's general objectives is "to provide stakeholders with the knowledge they need to make better decisions." The system's user-friendly interface and straightforward information presentation effectively fulfill this objective. By aligning specific objectives, such as "To make the system easy to use and understand," it highlights the comprehensive evaluation process and the overall success of the system.

Error Handling:

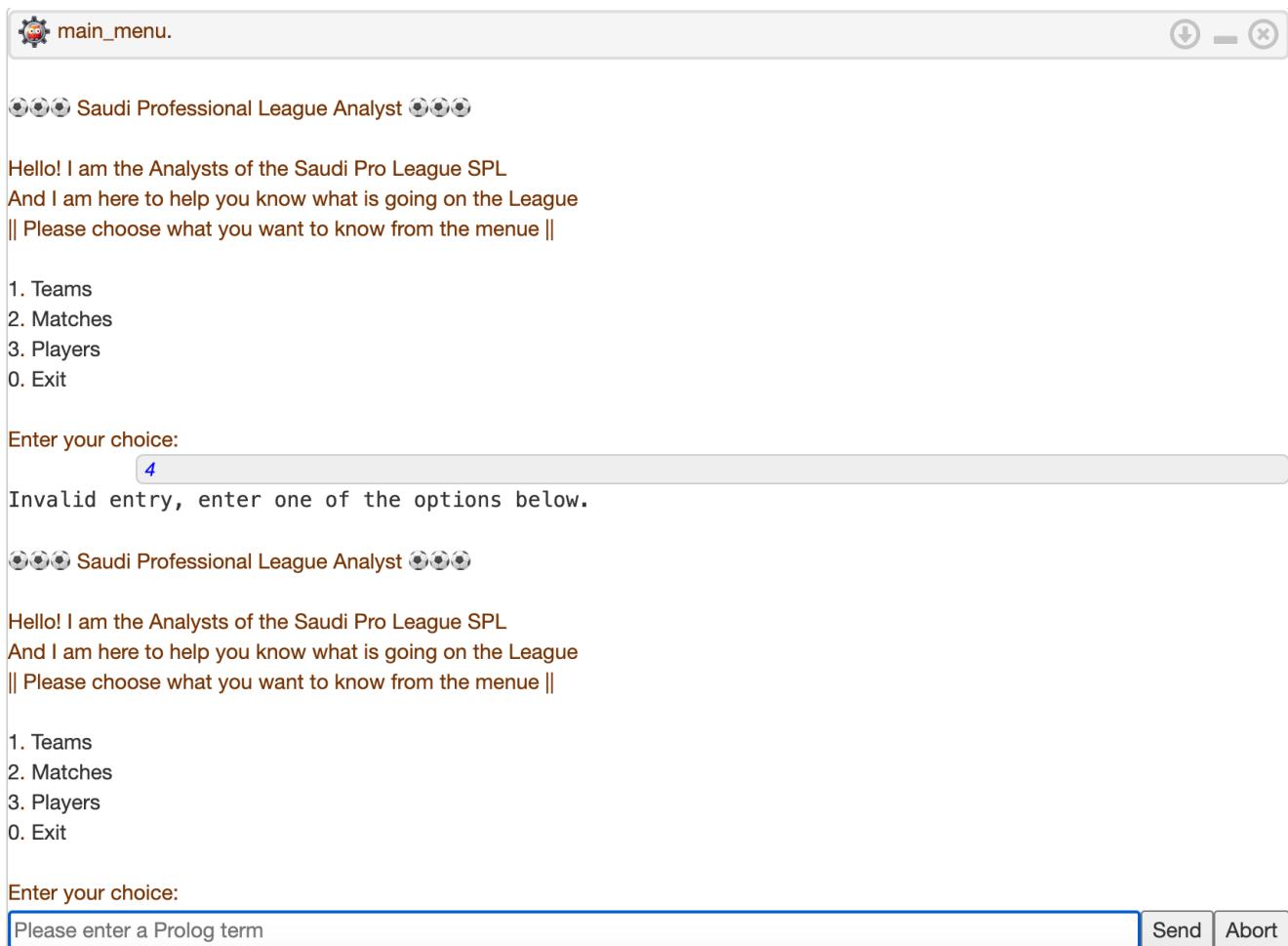


Figure 58: Error handling.

If the user enters invalid input, the error handling mechanism will return them to the main menu until valid input is provided.

Chapter 5: Conclusions and future work

Based on reliable data from the Saudi Professional League in 2023, an expert system was developed to analyze the Saudi Football League. A knowledge base was built in Swish Prolog that contains data for all matches during this season, as well as data on individual players and teams. A fan's most important information will be displayed as three main options: 1) Matches, 2) Teams, and 3) Players. By analyzing data for matches and players, the system assists coaches in developing future plans and trends based on players' results and strengths and weaknesses. Therefore, the Saudi Professional League's most important data was reviewed in order to meet the desired goals. In future work, questions will be asked directly to the expert system, and a wide variety of analysis methods will be used, including textual data, images, clips, Excel files, and other resources.

References

- [1] Newman, J. *et al.* (2023) ‘Automated pre-play analysis of American football formations using Deep Learning’, *Electronics*, 12(3), p. 726. doi:10.3390/electronics12030726.
- [2] Atmosukarto, I. *et al.* (2014) ‘Recognizing team formation in American football’, *Computer Vision in Sports*, pp. 271–291. doi:10.1007/978-3-319-09396-3_13.
- [3] Silva, J. R., Freitas, S. R., & Mendes, B. (2018). Running performance in Brazilian professional football players during a congested match schedule. *Journal of Strength and Conditioning Research*, 32(2), 487-493.
- [4] Malamatinos, M.-C., Vrochidou, E., & Papakostas, G. (2022). On predicting soccer outcomes in the Greek league using machine learning. *Computers*, 11(9), 133.
- [5] Constantinou, A. C., Fenton, N. E., & Neil, M. (2012). pi-football: A Bayesian network model for forecasting Association Football match outcomes. *Knowledge-Based Systems*, 36, 322-339.
- [6] “Saudi Pro League Football News, fixtures, scores & results,” Saudi Professional League Association, <https://www.spl.com.sa/en>.

Appendices

match(al-ahli, al-hazem, 3, 1).

match(al-tai, damac, 1, 0).

match(al-feiha, al-khaleej, 3, 1).

match(al-fateh, al-taawoun, 1, 1).

match(al-riyadh, al-wahda, 1, 0).

match(al-raed, al-ittihad, 3, 0).

match(abha, al-hilal, 1, 3).

match(al-ettifaq, al-nassr, 2, 1).

match(al-shabab, al-akhoud, 1, 1).

% matchday 1 of 34 ^

match(damac, al-riyadh, 2, 2).

match(al-khaleej, al-ahli, 1, 3).

match(al-akhoud, al-fateh, 1, 3).

match(al-wahda, al-shabab, 3, 1).

match(al-hazem, al-ettifaq, 0, 2).

match(al-nassr, al-taawoun, 0, 2).

match(abha, al-raed, 1, 0).

match(al-hilal, al-feiha, 1, 1).

match(al-ittihad, al-tai, 2, 0).

% Matchday 2 of 34 ^

match(al-tai, al-wahda, 0, 3).

match(al-ettifaq, al-khaleej, 1, 1).

match(al-ahli, al-akhoud, 1, 0).

match(al-raed, al-hilal, 0, 4).

match(al-riyadh, al-ittihad, 0, 4).

match(al-feiha, al-hazem, 0, 0).

match(al-shabab, damac, 1, 1).

match(al-fateh, al-nassr, 0, 5).

match(al-taawoun, abha, 1, 0).

% Matchday 3 of 34 ^

match(abha, al-feiha, 2, 1).

match(al-hilal, al-ettifaq, 2, 0).

match(al-wahda, al-ittihad, 0, 3).

match(al-raed, al-riyadh, 3, 0).

match(al-akhdoud, al-taawoun, 0, 1).

match(damac, al-fateh, 2, 2).

match(al-nassr, al-shabab, 4, 0).

match(al-khaleej, al-hazem, 1, 1).

match(al-ahli, al-tai, 2, 0).

% Matchday 4 of 34 ^

match(al-feiha, al-raed, 0, 0).

match(al-tai, abha, 1, 0).

match(al-hilal, al-ittihad, 4, 3).

match(al-akhdoud, al-riyadh, 1, 0).

match(al-hazem, al-nassr, 1, 5).

match(al-ahli, al-fateh, 1, 5).

match(al-ettifaq, damac, 3, 1).

match(al-shabab, al-khaleej, 1, 3).

match(al-taawoun, al-wahda, 4, 1).

% Matchday 5 of 34 ^

match(al-akhdoud, al-ittihad, 0, 1).

match(al-wahda, damac, 4, 2).
match(al-feiha, al-shabab, 0, 1).
match(al-hilal, al-riyadh, 6, 1).
match(al-khaleej, al-fateh, 1, 3).
match(abha, al-ettifaq, 1, 3).
match(al-hazem, al-tai, 1, 1).
match(al-raed, al-nassr, 1, 3).
match(al-taawoun, al-ahli, 2, 3).
% Matchday 6 of 34 ^
match(al-ettifaq, al-tai, 4, 3).
match(al-taawoun, al-raed, 2, 1).
match(damac, al-hilal, 1, 1).
match(al-shabab, al-hazem, 4, 1).
match(al-itihad, al-fateh, 2, 1).
match(al-riyadh, al-feiha, 1, 3).
match(al-akhdoud, al-khaleej, 0, 1).
match(al-wahda, abha, 4, 0).
match(al-nassr, al-ahli, 4, 3).
% Matchday 7 of 34 ^
match(al-hazem, al-taawoun, 1, 3).
match(al-tai, al-nassr, 1, 2).
match(al-feiha, al-itihad, 0, 0).
match(al-hilal, al-shabab, 2, 0).
match(abha, al-riyadh, 0, 1).
match(al-raed, al-akhdoud, 1, 2).
match(al-fateh, al-wahda, 5, 1).
match(al-ahli, al-ettifaq, 0, 0).

match(al-khaleej, damac, 0, 2).

% Matchday 8 of 34 ^

match(damac, al-hazem, 4, 1).

match(al-riyadh, alshabab, 2, 2).

match(al-taawoun, al-tai, 3, 0).

match(al-ettifaq, al-fateh, 1, 2).

match(al-nassr, abha, 2, 2).

match(al-ittihad, al-ahli, 0, 1).

match(al-akhdoud, al-hilal, 0, 3).

match(al-khaleej, al-raed, 0, 0).

match(al-wahda, al-feiha, 1, 1).

% Matchday 9 of 34 ^

match(al-taawoun, al-ittihad, 1, 1).

match(al-akhdoud, al-feiha, 1, 2).

match(al-fateh, abha, 4, 1).

match(al-hilal, al-khaleej, 1, 0).

match(al-nassr, damac, 2, 1).

match(al-hazem, al-raed, 4, 3).

match(al-shabab, al-tai, 2, 0).

match(al-ahli, al-wahda, 3, 1).

match(al-riyadh, al-ettifaq, 1, 0).

% Matchday 10 of 34 ^

match(al-khaleej, al-taawoun, 1, 1).

match(al-akhdoud, damac, 0, 2).

match(al-ittihad, al-hazem, 2, 2).

match(al-raed, al-fateh, 1, 2).

match(al-tai, al-riyadh, 3, 2).

```
match(al-hilal, al-ahli, 3, 1).  
match(abha, al-shabab, 2, 1).  
match(al-feiha, al-nassr, 3, 1).  
match(al-wahda, al-ettifaq, 2, 3).
```

```
% Matchday 11 of 34 ^  
  
match(al-fateh, al-hilal, 0, 2).  
match(al-tai, al-feiha, 3, 3).  
match(al-ittihad, al-shabab, 0, 1).  
match(abha, al-akhdoud, 3, 2).  
match(al-khaleej, al-nassr, 0, 2).  
match(al-raed, al-ettifaq, 0, 0).  
match(al-hazem, al-wahda, 1, 2).  
match(al-taawoun, damac, 0, 0).  
match(al-riyadh, al-ahli, 0, 3).
```

```
% Matchday 12 of 34 ^  
  
match(al-raed, al-shabab, 2, 1).  
match(al-khaleej, al-tai, 3, 1).  
match(damac, al-ahli, 2, 2).  
match(al-fateh, al-riyadh, 1, 1).  
match(al-hilal, al-taawoun, 2, 0).  
match(abha, al-ittihad, 4, 2).  
match(al-hazem, al-akhdoud, 1, 2).  
match(al-wahda, al-nassr, 1, 3).  
match(al-feiha, al-ettifaq, 0, 0).
```

```
% Matchday 13 of 34 ^  
  
match(al-taawoun, al-riyadh, 1, 2).  
match(al-ettifaq, al-ittihad, 1, 1).
```

match(al-nassr, al-akhdoud, 3, 0).

match(al-tai, al-raed, 4, 3).

match(al-hazem, al-hilal, 0, 9).

match(abha, damac, 4, 2).

match(al-wahda, al-khaleej, 3, 1).

match(al-ahli, al-shabab, 0, 0).

match(al-fateh, al-feiha, 2, 3).

% Matchday 14 of 34 ^

match(al-riyadh, al-hazem, 0, 1).

match(abha, al-ahli, 0, 6).

match(al-ittihad, al-khaleej, 4, 2).

match(al-hilal, al-nassr, 3, 0).

% Matchday 15 of 34 ^

assist('Riyad Mahrez', 'Al Ahli Jeddah', 7).

assist('Cristiano Ronaldo', 'Al Nassr FC Riyadh', 7).

assist('Mourad Batna', 'Al Fateh', 7).

assist('Alvaro Medran', 'Al Taawoun', 6).

assist('Faycal Fajr', 'Al Wehda Mecca', 5).

assist('Igor Coronado', 'Ittihad Jeddah', 5).

assist('Abdulrahman Ghareeb', 'Al Nassr FC Riyadh', 5).

assist('Abdulaziz Noor', 'Al Wehda Mecca', 5).

assist('Jordan Henderson', 'Al Ettifaq', 4).

assist('Karim Benzema', 'Ittihad Jeddah', 4).

assist('Sergej Milinkovic-Savic', 'Al Hilal Riyadh', 4).

assist('Yannick Carrasco', 'Al Shabab Riyadh', 4).

assist('Georges Nkoudou', 'Dhamk', 4).
assist('Allan Saint-Maximin', 'Al Ahli Jeddah', 4).
assist('Malcom', 'Al Hilal Riyadh', 4).
assist('Lucas Zelarayan', 'Al Fateh', 4).
assist('Toze', 'Al Hazm', 4).
assist('Nicolae Stanciu', 'Dhamk', 4).
assist('Sultan Al Ghanam', 'Al Nassr FC Riyadh', 4).
assist('Firas Al-Braikan', 'Al Ahli Jeddah', 4).

yellowCard('Abdulbasit Hindi','Al Ahli Jeddah', 7).
yellowCard('Florin Tanase','Al-Akhoud', 6).
yellowCard('Roger Ibanez','Al Ahli Jeddah', 6).
yellowCard('Iago Santos','Al Shabab Riyadh', 5).
yellowCard('Ivo Rodrigues','Al Khaleej Club', 5).
yellowCard('Tarek Hamed','Dhamk', 5).
yellowCard('Jordan Henderson','Al Ettifaq', 4).
yellowCard('Waleed Bakshween','Al Wehda Mecca', 4).
yellowCard('Ruben Neves','Al Hilal Riyadh', 4).
yellowCard('Fabio Martins','Al Khaleej Club', 4).
yellowCard('Gustavo Cuellar','Al Shabab Riyadh', 4).
yellowCard('Romain Saiss','Al Shabab Riyadh', 4).
yellowCard('Flavio', 'Al Taawoun',4).
yellowCard('Hamad Al Jayzani','Al Raed', 4).
yellowCard('Ali Al-Bulaihi','Al Hilal Riyadh', 4).
yellowCard('Abdullah Alkhaibari','Al Nassr FC Riyadh', 4).
yellowCard('Woo-Young Jung','Al Khaleej Club', 4).

yellowCard('Mansor Al Beshe', 'Al Raed', 4).

yellowCard('Mohammed Al Doseri', 'Al Raed', 4).

yellowCard('Aloyayari Abdulmalik', 'Al Taawoun', 4).

redCard('Ever Banega', 'Al Shabab Riyadh', 1).

redCard('Sergej Milinkovic-Savic', 'Al Hilal Riyadh', 1).

redCard('Hamed Al Mansour', 'Al-Akhoud', 1).

redCard('Khaled Narey', 'Al Khaleej Club', 1).

redCard('Iago Santos', 'Al Shabab Riyadh', 1).

redCard('Alvaro Medran', 'Al Taawoun', 1).

redCard('Ahmad Al Hbeab', 'Abha Club', 1).

redCard('Marwane Saadane', 'Al Fateh', 1).

redCard('Bruno Viana', 'Al Hazm', 1).

redCard('Sultan Al Ghanam', 'Al Nassr FC Riyadh', 1).

redCard('Saeed Alyami', 'Al-Akhoud', 1).

redCard('Alaa Hejji', 'Al Wehda Mecca', 1).

redCard('Ali Al-Bulaihi', 'Al Hilal Riyadh', 1).

redCard('Mukhtar Ali', 'Al Fateh', 1).

redCard('Alfa Semedo', 'Al Ta i', 1).

redCard('Abdelfatah Adam', 'Al Taawoun', 1).

redCard('Merih Demiral', 'Al Ahli Jeddah', 1).

redCard('Abdulbasit Hindi', 'Al Ahli Jeddah', 1).

redCard('Alex Collado', 'Al-Akhoud', 1).

redCard('Mansor Al Beshe', 'Al Raed', 1).

goals('Cristiano Ronaldo', 'Al Nassr FC Riyadh', 15).

goals('Aleksandar Mitrovic', 'Al Hilal Riyadh', 13).

goals('Georges NKoudou', 'Dhamk', 11).

goals('Karim Benzema', 'Ittihad Jeddah', 9).

goals('Malcom', 'Al Hilal Riyadh', 9).

goals('Bernard Mensah', 'Al Ta i', 8).

goals('Odion Ighalo', 'Al Wehda Mecca', 8).

goals('Firas Al-Braikan', 'Al Ahli Jeddah', 8).

goals('Anderson Talisca', 'Al Nassr FC Riyadh', 8).

goals('Abderrazak Hamdallah', 'Ittihad Jeddah', 7).

goals('Salem Al Dawsari', 'Al Hilal Riyadh', 7).

goals('Mourad Batna', 'Al Fathe', 7).

goals('Moussa Demb 莫 1茅', 'Al Ettifaq', 7).

goals('Fabio Martins', 'Al Khaleej Club', 6).

goals('Riyad Mahrez', 'Al Ahli Jeddah', 6).

goals('Cristian Tello', 'Al Fathe', 6).

goals('Assan Ceesay', 'Dhamk', 6).

goals('Fashion Sakala', 'Al Feiha', 6).

goals('Sadio Man 莫', 'Al Nassr FC Riyadh', 6).

goals('Saleh Al Abbas', 'Al Riyadh SC', 6).

team(al-hilal).

team(al-nassr).

team(al-ahli).

team(al-ittihad).

team(al-taawoun).

team(al-fateh).

team(al-ettifaq).

team(al-feiha).

team(al-wadha).

team(damac).

team(al-shabab).

team(al-riyadh).

team(al-tai).

team(al-khaleej).

team(abha).

team(al-akhdoud).

team(al-raed).

team(al-hazem).

% List of teams

list_of_teams(TeamsList):- % to generate the entire list of teams

`findall(X team(X) TeamsList), % the body of the predicate`

% The team with the most points

team points(T):-

list of teams(Teams).

points team(Teams Points).

`max member(MaxPoints Points) % Get the maximum points`

```
nth1(Index, Points, MaxPoints), % Get the index of the maximum points  
nth1(Index, Teams, T),!. % Retrieve the team at that index
```

```
points_team([],[]).
```

```
points_team([X|T],[Points|Rest]):-  
    findall((X,G1,G2),(match(X,_,G1,G2);match(_,X,G2,G1)),L),  
    count_points(L,Points),  
    points_team(T,Rest).
```

```
count_points([], 0):-!.
```

```
count_points([(_,G1,G2)|Results], Points) :-  
    G is G1 - G2,  
    (G < 0 -> PointsRest = 1; G > 0 -> PointsRest = 3; PointsRest = 0),  
    count_points(Results, Rest),  
    Points is PointsRest + Rest.
```

```
% The team with the most goals
```

```
team_goals(T):-  
    list_of_teams(Teams),  
    goals_team(Teams,Goals),  
    max_member(MaxGoals, Goals), % Get the maximum goals  
    nth1(Index, Goals, MaxGoals), % Get the index of the maximum goals  
    nth1(Index, Teams, T),!. % Retrieve the team at that index
```

```
goals_team([],[]). % handles the case where the input list of teams is empty  
goals_team([X|T],[Goals|Rest]):-
```

```
findall((X,G1),(match(X,_,G1,_);match(_,X,_,G1)),L),
count_goals(L,Goals),
goals_team(T,Rest).
```

```
count_goals([], 0):-!.
count_goals([(_,G1)|Results], Goals) :-
    count_goals(Results, Rest),
    Goals is G1 + Rest.
```

% The team conceded the least goals

```
team_conceded_goals(T):-
    list_of_teams(Teams),
    conceded_goals(Teams,Goals),
    min_list(Goals, MinGoals), % Get the minimum value in Goals
    nth1(Index, Goals, MinGoals), % Get the index of the minimum value
    nth1(Index, Teams, T),!. % Retrieve the team at that index
```

```
conceded_goals([],[]).
```

```
conceded_goals([X|T],[Goals|Rest]):-
    findall(Goal, (match(X, _, _, Goal); match(_, X, Goal, _)), GoalsList),
    sum_list(GoalsList, Goals),
    conceded_goals(T,Rest).
```

% Most team won

```
team_won(T):-
    list_of_teams(Teams),
```

```
wins(Teams,Wins),  
max_member(MaxWins, Wins), % Get the maximum wins  
nth1(Index, Wins, MaxWins), % Get the index of the maximum wins  
nth1(Index, Teams, T),!. % Retrieve the team at that index
```

```
wins([],[]).
```

```
wins([X|T],[Wins|Rest]):-  
    findall((X,G1,G2),(match(X,_,G1,G2);match( _,X,G2,G1)),L),  
    count_wins(L,Wins),  
    wins(T,Rest).
```

```
count_wins([], 0):-!.
```

```
count_wins([( _,G1,G2)|Results], Wins) :-  
    G is G1 - G2,  
    (G <= 0 -> WinsRest = 0; WinsRest = 1),  
    count_wins(Results, Rest),  
    Wins is WinsRest + Rest.
```

```
% The team that lost the least
```

```
team_lost(T):-  
    list_of_teams(Teams),  
    losses(Teams,Losses),  
    min_member(MinLosses, Losses), % Get the minimum losses  
    nth1(Index, Losses, MinLosses), % Get the index of the minimum losses  
    nth1(Index, Teams, T),!. % Retrieve the team at that index
```

```
losses([],[]).
```

```
losses([X|T],[Losses|Rest]):-  
    findall((X,G1,G2),(match(X,_,G1,G2);match(_,X,G2,G1)),L),  
    count_losses(L,Losses),  
    losses(T,Rest).
```

```
count_losses([], 0):-!.  
count_losses([(_,G1,G2)|Results], Losses) :-  
    G is G1 - G2,  
    (G <= 0 -> LossesRest = 1; LossesRest = 0),  
    count_losses(Results, Rest),  
    Losses is LossesRest + Rest.
```

```
% Most drawn team  
team_draw(T):-  
    list_of_teams(Teams),  
    draws(Teams,Draws),  
    max_member(MaxDraws, Draws), % Get the maximum draws  
    nth1(Index, Draws, MaxDraws), % Get the index of the maximum draws  
    nth1(Index, Teams, T),!. % Retrieve the team at that index
```

```
draws([],[]).  
draws([X|T],[Draws|Rest]):-  
    findall((X,G1,G2),(match(X,_,G1,G2);match(_,X,G2,G1)),L),  
    count_draws(L,Draws),  
    draws(T,Rest).
```

```
count_draws([], 0):-!.
```

```
count_draws([(_,_G1,G2)|Results], Draws) :-  
    G is G1 - G2,  
    (G is 0 -> DrawsRest = 1; DrawsRest = 0),  
    count_draws(Results, Rest),  
    Draws is DrawsRest + Rest.
```

%% MATCHES

%List of matches

list_of_matches(M):-

```
findall((X,Y:G1-G2),match(X,Y,G1,G2),M).
```

```
print_match((X,Y:G1-G2)):-
```

```
format("~w ~w - ~w ~w",[X,G1,G2,Y]).
```

%Most goals scored match

most goal match(M):-

list of matches(Matches),

most goal(Matches,Goals),

max member(MaxGoals, Goals), % Get the maximum goals

`nth1(Index, Goals, MaxGoals), % Get the index of the maximum goals`

`nth1(Index, Matches, M).! % Retrieve the match at that index`

most goal([],[]).

```
most goal([( , :G1-G2)|T],[Goals|Rest]):-
```

```
Goals is G1+G2,
```

```
most_goal(T,Rest).
```

```
%The match that conceded the least goals
```

```
min_goal_match(M):-
```

```
    list_of_matches(Matches),
```

```
    most_goal(Matches,Goals),
```

```
    min_member(MinGoals, Goals), % Get the minimum goals
```

```
    nth1(Index, Goals, MinGoals), % Get the index of the minimum goals
```

```
    nth1(Index, Matches, M),!. % Retrieve the match at that index
```

```
%%%%%%%%%%%%%%  
%%%%% PLAYERS  
%%%%%  
%%%%%
```

```
list_of_players(P):-
```

```
    findall(Name,(
```

```
        assist(Name, _, _);
```

```
        yellowCard(Name, _, _);
```

```
        redCard(Name, _, _);
```

```
        goals(Name, _, _)
```

```
    ),P).
```

```
%The player who scored the most goals
```

```
player_scored_most(Player) :-
```

```
    findall(goals(Name, Team, Goals), goals(Name, Team, Goals), GoalsList),
```

```
player_with_most_goals(GoalsList, Player),!.
```

```
player_with_most_goals(GoalsList, (Player, Team, MaxGoals)) :-  
    maplist(arg(3), GoalsList, GoalsOnly),  
    max_list(GoalsOnly, MaxGoals),  
    member(goals(Player, Team, MaxGoals), GoalsList).
```

%The player who made the most goals

```
player_made_most(Player) :-  
    findall(assist(Name, Team, Assists), assist(Name, Team, Assists), AssistsList),  
    player_with_most_assists(AssistsList, Player).
```

```
player_with_most_assists(AssistsList, (Player, Team, MaxAssists)) :-
```

```
    maplist(arg(3), AssistsList, AssistsOnly),  
    max_list(AssistsOnly, MaxAssists),  
    member(assist(Player, Team, MaxAssists), AssistsList).
```

% The player who received the most yellow cards

```
player_received_most_yellow_card(Player) :-  
    findall(yellowCard(Name, Team, YellowCards), yellowCard(Name, Team, YellowCards),  
    YellowCardsList),  
    player_with_most_yellow_cards(YellowCardsList, Player).
```

```
player_with_most_yellow_cards(YellowCardsList, (Player, Team, MaxYellowCards)) :-
```

```
    maplist(arg(3), YellowCardsList, YellowCardsOnly),  
    max_list(YellowCardsOnly, MaxYellowCards),  
    member(yellowCard(Player, Team, MaxYellowCards), YellowCardsList).
```

```
% The player who received the most red cards
```

```
player_received_most_red_card(Player) :-
```

```
    findall(redCard(Name, Team, RedCards), redCard(Name, Team, RedCards), RedCardsList),
```

```
    player_with_most_red_cards(RedCardsList, Player).
```

```
player_with_most_red_cards(RedCardsList, (Player, Team, MaxRedCards)) :-
```

```
    maplist(arg(3), RedCardsList, RedCardsOnly),
```

```
    max_list(RedCardsOnly, MaxRedCards),
```

```
    member(redCard(Player, Team, MaxRedCards), RedCardsList).
```

```
% Define your top-level menu options
```

```
top_menu_option(1, "Teams").
```

```
top_menu_option(2, "Matches").
```

```
top_menu_option(3, "Players").
```

```
top_menu_option(0, "Exit").
```

```
% Define predicates to display the top-level menu
```

```
display_top_menu :-
```

```
nl,
```

```
write('⚽⚽⚽ ⚽ Saudi Professional League Analyst ⚽⚽⚽'), nl,nl,
```

```
write('Hello! I am the Analysts of the Saudi Pro League SPL'), nl,
```

```
write('And I am here to help you know what is going on the League'), nl,
```

```
write('|| Please choose what you want to know from the menu ||'), nl,nl,
```

```
forall(top_menu_option(Index, Option),
```

```

(write(Index), write('. '), write(Option), nl)),

nl.

% Define predicates to handle top-level menu options

handle_top_option(0) :- write('I hope you enjoy, see you later...').

handle_top_option(1) :- team_submenu.

handle_top_option(2) :- match_submenu.

handle_top_option(3) :- player_submenu.

handle_top_option(_) :- format("Invalid entry, enter one of the options below.\n").

% Display function for the team submenu

display_team_submenu :-  

    nl,  

    write('⚽⚽⚽ TEAM ⚽⚽⚽'), nl,nl,  

    write('I have multiple things that I can let you know about it'), nl,  

    write('|| Choose what you are interested in knowing!! ||'), nl,nl,  

    forall(team_submenu_option(Index, Option),  

        (write(Index), write('. '), write(Option), nl)),  

    nl.

% Display function for the match submenu

display_match_submenu :-  

    nl,  

    write('⚽⚽⚽ MATCH ⚽⚽⚽'), nl,nl,  

    write('I have multiple things that I can let you know about it'), nl,  

    write('|| Choose what you are interested in knowing!! ||'), nl,nl,  

    forall(match_submenu_option(Index, Option),

```

```
(write(Index), write('. '), write(Option), nl)),  
nl.  
  
% Display function for the player submenu  
display_player_submenu :-  
nl,  
write('⚽⚽⚽ PLAYER ⚽⚽⚽'), nl,nl,  
write('I have multiple things that I can let you know about it'), nl,  
write('|| Choose what you are interested in knowing!! ||'), nl,nl,  
forall(player_submenu_option(Index, Option),  
      (write(Index), write('. '), write(Option), nl)),  
nl.
```

% Define the main top-level menu loop

```
main_menu :-  
display_top_menu,  
write('Enter your choice: '),
read(Choice),
handle_top_option(Choice),
(Choice == 0 -> ! ; main_menu).
```

% Define the team submenu options

```
team_submenu_option(1, "Team with the most points").  
team_submenu_option(2, "Team with the most goals").  
team_submenu_option(3, "Team that conceded the least goals").  
team_submenu_option(4, "Team with the most wins").
```

```
team_submenu_option(5, "Team that lost the least").  
team_submenu_option(6, "Team with the most draws").  
team_submenu_option(0, "Exit").
```

```
% Define predicates to handle team submenu options  
  
handle_team_submenu_option(0) :- write('Exiting...').  
  
handle_team_submenu_option(1) :- team_points(T), write('Team with the most points: '), writeln(T).  
handle_team_submenu_option(2) :- team_goals(T), write('Team with the most goals: '), writeln(T).  
  
handle_team_submenu_option(3) :- team_conceded_goals(T), write('Team that conceded the least goals: '), writeln(T).  
  
handle_team_submenu_option(4) :- team_won(T), write('Team with the most wins: '), writeln(T).  
  
handle_team_submenu_option(5) :- team_lost(T), write('Team that lost the least: '), writeln(T).  
handle_team_submenu_option(6) :- team_draw(T), write('Team with the most draws: '), writeln(T).
```

```
% Define the team submenu loop
```

```
team_submenu :-  
    display_team_submenu,  
    write('Enter your choice: '),
    read(Choice),
    handle_team_submenu_option(Choice),
    (Choice == 0 -> ! ; team_submenu).
```

```
% Define predicates to handle match submenu options
```

```
match_submenu_option(1, "Match with the most goals").
```

```
match_submenu_option(2, "Match that conceded the least goals").
```

```
match_submenu_option(0, "Exit").
```

```
% Define the match submenu loop
```

```
match_submenu :-
```

```
    display_match_submenu,  
    write('Enter your choice: '),
    read(Choice),
    handle_match_submenu_option(Choice),
    (Choice == 0 -> ! ; match_submenu).
```

```
handle_match_submenu_option(0) :- write('Exiting...').
```

```
handle_match_submenu_option(1) :- most_goal_match(M), write('Match with the most goals: '), M = (X,Y:G1-G2), format('~w ~w - ~w ~w',[X,G1,G2,Y]),nl.
```

```
handle_match_submenu_option(2) :- min_goal_match(M), write('Match that conceded the least goals: '), M = (X,Y:G1-G2), format('~w ~w - ~w ~w',[X,G1,G2,Y]),nl.
```

```
% Define predicates to handle match player options
```

```
% Define the match submenu loop
```

```
player_submenu :-
```

```
    display_player_submenu,
    write('Enter your choice: '),
    read(Choice),
    handle_player_submenu_option(Choice),
    (Choice == 0 -> ! ; player_submenu).
```

```
player_submenu_option(1, "Player who scored the most goals").  
player_submenu_option(2, "Player who made the most assists").  
player_submenu_option(3, "Player who received the most yellow cards").  
player_submenu_option(4, "Player who received the most red cards").  
player_submenu_option(0, "Exit").
```

```
handle_player_submenu_option(0) :- write('Exiting...').
```

```
handle_player_submenu_option(1) :-  
    findall(P, player_scored_most(P), L),  
    print_goals(L).
```

```
handle_player_submenu_option(2) :-  
    findall(P, player_made_most(P), L),  
    print_assists(L).
```

```
handle_player_submenu_option(3) :-  
    findall(P, player_received_most_yellow_card(P), L),  
    print_yellow_cards(L).
```

```
handle_player_submenu_option(4) :-
```

```
    findall(P, player_received_most_red_card(P), L),  
    print_red_cards(L).
```

```
print_red_cards([]).
```

```
print_red_cards([(Player, Team, RedCards)|Rest]) :-
```

```
    format('Player who received the most red cards: ~w from team ~w with ~w red cards.~n', [Player, Team, RedCards]),
```

```
    print_red_cards(Rest).
```

```
print_goals([]).
```

```
print_goals([(Player, Team, Goals)|Rest]) :-
```

```
    format('Player who scored the most goals: ~w from team ~w with ~w goals.~n', [Player, Team, Goals]), print_goals(Rest).
```

```
print_assists([]).
```

```
print_assists([(Player, Team, Assists)|Rest]) :-
```

```
    format('Player who made the most assists: ~w from team ~w with ~w assists.~n', [Player, Team, Assists]),
```

```
    print_assists(Rest).
```

```
print_yellow_cards([]).
```

```
print_yellow_cards([(Player, Team, YellowCards)|Rest]) :-
```

```
    format('Player who received the most yellow cards: ~w from team ~w with ~w yellow cards.~n', [Player, Team, YellowCards]),
```

```
    print_yellow_cards(Rest).
```