



**ADDIS ABABA UNIVERSITY**  
**SCHOOL OF GRADUATE STUDIES**  
FACULTY OF COMPUTER AND MATHEMATICAL  
SCIENCES  
DEPARTMENT OF COMPUTER SCIENCE

Premier and Bherawi League Management System for Ethiopian  
Football Federation

By  
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## List of Acronyms

EFF	Ethiopian Football Federation
PBLMS	Premier and Bherawi League Management System
RDBMS	Relational Database Management System
FIFA	Federation of International Football Association
CAF	Confederation of African Football
A.A	Addis Ababa
FC	Football Club
URL	Unified Resource Locator
GUI	Graphical User Interface
ASP	Active Server Pages
IIS	Internet Information Server

## Abstract

Sports like football have worldwide appeal. It plays one of the most significant roles in the everyday life of people around the world, for both those who actively participate in it or those who just watch and support it. Reflected by the mass media, football today has not only become great entertainment, an occupation and a lifestyle, but solid business as well. Professional and amateur football leagues face challenging management problems involving logistics, revenue maximization, schedule fairness issues and game attractiveness, among other aspects. Naturally, the schedule of the matches which consists of assigning referees to games, determining the date and the venue in which each game will be played is of great importance, since it has a considerable impact on the costs or revenues of all parties involved.

The current mechanism for handling scheduling and seat reservation processes in Ethiopian leagues is limited to manual work. Thus, in this project work we designed and implemented a web based Premier and Bherawi League management system that satisfies the constraints specified by the Ethiopian Football Federation. The prototype was also validated with real data from the federation and its performance was found to be very good.

**Keywords:** Football, Premier League, Bherawi League, Scheduling, Reservation, Referee Assignment.

# Chapter One: Introduction

## *1.1 Background*

Sports have worldwide appeal. Professional sport leagues involve significant investments in players. Events such as the Olympics Games, the Football World Cup and the major golf and tennis tournaments generate huge worldwide television audiences and many sports are multi-million dollar industries. A key aspect of sporting events is the ability to generate schedules that optimize logistic issues and that are seen as fair to all those who have an interest. This is not just restricted to generating the fixtures, but also to other areas such as assigning officials to the games in the competitions [1].

There has been a steady increase in sports scheduling articles, demonstrating that scientific interest is greater than ever in the area in recent years. This is due not only to the intrinsic computational difficulty of the problems in the area and to their challenging nature but is also motivated by a large number of innovative applications in practice. In fact sporting events continue to generate a lot of public interest with fairness and technical criteria to be respected. Thus, developing practical solutions for the scheduling of regular-season matches in a professional sports league will probably bring a clear importance in the sports management literature.

One of the widely available sport leagues in the world is football league. These days, football in the world becomes so popular that everybody speaks about it as a common language. It is in everyday life that football culture is primarily perpetuated, expressed and experienced. That is to say that the spectacle of match-days and the actuality of football teams' performances and results play an important part for many people especially for supporters. It is the primary aspect of football culture that affects individuals' notions of self-identity, belonging and interpersonal relations; all of which are initiated, reinforced and challenged through the enactment, internalization, embodiment and contestation of structural influences within the daily practices of life [2].

Football culture is actually spread in different parts of the world at different times. Ethiopia is one of the first African countries which started football at the early stage. Like education, transportation and entertainment, Ethiopian football also requires up-to-date information for day to day activities, and needs a body for the management and decision making. For this to be achieved, the Ethiopian Football Federation was established in 1943 as the governing body of football in Ethiopia. The federation also became affiliated to FIFA in 1953 and to CAF in 1957 [3].

Today, the EFF is headed by a president and its day to day activities are carried out by an executive committee which has seven sub committees.

## ***1.2 Statement of the Problem***

The Ethiopian Football Federation organizes the national football league competitions and manages the national team. One of the main responsibilities of the federation is to organize and manage the Premier and Bherawi league tournaments. Keeping track of clubs along with the details of their players, scheduling matches and assigning referees and commissioners are the crucial tasks of the organization. It also keeps record of different match statistics. Furthermore, it produces communiqués and other reports in order to communicate with clubs, players, regional federations, the general public as well as other concerned authorities within and outside the organization.

The current match schedule management system in the Ethiopian Football Federation is manual. When the competition organizing committee needs to register clubs or players, it will use the forms provided to record the different required information. A member concerned with this task has to check the validity of contracts between players and clubs, visa and work permits of foreign players to enforce different rules. A member of the competition organizing committee must also record match statistics of the completed games and prepare different reports necessary for financial repercussions or the general public.

The preparation of competition schedule for the entire competition season is also the responsibility of the competition organizing committee. It assigns lottery numbers to the registered clubs and applies an algorithm to produce the schedule. Since the competition schedule is prepared manually, there is always a probability of unfair match time distribution across teams which might adversely affect the teams' game result. For instance; in 2009/2010 competition year, it has been found that out of 36 league games Kidus Georgis FC has played 8 league games at 3:00PM while its opponent Dedebit FC played 12 league games at similar time. This has a negative impact for some teams hence new mechanism has to be devised to minimize unfair match time distribution and avoid teams' complain.

There are also other problems in the existing system which is related to fans and teams. Fans do not have opportunities to view match schedules, team information and league tables before the match unless they read from newspapers. On the other hand, teams also must be present in person or communicate through phone to know about their penalized players for next matches and decisions related to financial penalties.

Moreover, fans do not have a chance to reserve seat before the match. They have to come to a ticket office on the day of the match which may cause a long queue and results in fans' dissatisfaction.

### ***1.3 Objective of the Project***

#### **1.3.1 General Objective**

The general objective of this project is to develop a web based Premier and Bherawi league management system for the Ethiopian Football Federation.

#### **1.3.2 Specific objectives:**

The specific objectives include:

- Developing scheduling and reservation algorithms
- Developing prototype of the system
- Evaluating the prototype

## ***1.4 Scope of the Project***

The project mainly focuses on the match schedule management for the Premier and Bherawi leagues and also seat reservation for fans exceptionally for A.A stadium matches. Other indirectly related system like finance system/credit system is not addressed here.

## ***1.5 Methodology***

For the successful completion of this project work, literature review, data gathering, analysis, and programming tools and techniques are put into use. The following list will describe the methods used in this work.

### **1.5.1 Literature review**

The literature review part has focused on reviewing the basic fixture scheduling theories and seat reservation issues.

### **1.5.2 Data collection**

For the purpose of requirement gathering and determination of the system both primary and secondary sources of data are used. Primary data source includes: interviewing respective personnel in the federation, collecting fans' and workers' feedback about the existing system and conducting observational study. Whereas secondary data source comprises relevant documents, forms of the federation as well as information from web. The interview questions are annexed.

## ***1.6 Organization of the Document***

The document consists of seven Chapters including this Chapter. Chapter Two gives a literature review on scheduling theories and seat reservation issues. The requirement determination and analysis is discussed in detail in Chapter Three. Chapter Four discusses about the design goals, the system architecture and the overall system design issues. The implementation is discussed in Chapter Five and the evaluation of the prototype is overviewed in Chapter Six. The conclusion and recommendations drawn from the project are briefly explained in Chapter Seven.

## Chapter Two: Literature Review

### 2.1 Overview

Sports scheduling and management has been attracting the attention of an increasing number of researchers in multidisciplinary areas such as operations research, scheduling theory, constraint programming, graph theory, combinatorial optimization, and applied mathematics. Different optimization techniques have been applied to solve problems arising from sports scheduling and management. The difficulty of the problems in the field led to the use of a number of exact and approximate approaches, including integer programming, constraint programming, and hybrid methods [1].

The general problem of scheduling the games of a tournament is certainly the most studied area of sports scheduling. It consists of determining the date and the venue in which each game will be played. Applications to real-life problems in the scheduling of tournaments of sports such as football, baseball, basketball, cricket, and others are common in the literature. However, there are also other relevant scheduling problems in sports. One of them is that of assigning referees to games.

To support the idea of this project, similar works on the area have been assessed **in the country** as well as in other countries. Even though no documentation and products are found in Ethiopia to be reviewed, some products and documents have been observed in some parts of the world. There are a number of various works on web based football league scheduling systems and seat reservation systems. Amongst, the followings are reviewed.

### 2.2 Football League Scheduling in Europe

Especially in Europe, soccer has become big business, involving many parties (e.g. teams, police, broadcasting companies ...) and a lot of money. The schedule of the matches is of great importance since it has a considerable impact on the costs or revenues of all parties involved. Each party has its (possibly conflicting) constraints and wishes which makes it hard to generate a schedule that is considered fair and acceptable to all parties [4]. In this section we look into some of related works on league scheduling systems in Europe.

### **2.2.1. English Premier League**

The English Premier League is one of the most high profile, and successful football leagues in the world. It comprises 20 teams which have to play each other both at home and away (i.e. a double round robin tournament), resulting in 380 fixtures that have to be scheduled. The other three main divisions in England (the Championship, League One and League Two) each have 24 teams, resulting in 552 fixtures having to be scheduled for each division. Therefore, for the four main divisions in England 2036 fixtures have to be scheduled every season. The divisions operate a system of promotion and relegation such that the teams in each division changes each year so it is not possible to simply use the same schedule every time. In [5], the authors carried out a more in depth study by considering more seasons and carrying out statistical analysis of the results in order to draw stronger conclusions. According to the study, the distances travelled by the supporters are the minimum when compared to other fixtures when all teams play. In addition, there are various other constraints that have to be respected, the aim was to include in their model details about public transport as some routes might be more difficult than others even if they are shorter. They also plan to run their algorithms for every future season as well as for previous seasons. Executing the algorithm is not the main issue. The purpose of the study is to investigate if there is an acceptable trade-off between the minimization of distance and the minimization of pair clashes. The study suggests that it may be possible to minimize both of these competing objectives but still produce results which are acceptable to both the supporters (who are interested in minimizing the amount they travel) and the police (who are interested in having fewer pair clashes).

### **2.2.2 Danish League**

The Danish league consists of 12 teams and has a somewhat unusual structure compared to most sports leagues. The league differs from most sports leagues since it plays a triple round robin tournament which leads to an uneven distribution of home and away games. As most sports scheduling applications, this is also a hard problem since a large number of constraints are present and these constraints are often conflicting. [6] presents an algorithm for finding a seasonal schedule for the best Danish soccer league (SAS Ligaen). Many types of constraints have already been considered in the sports scheduling literature. However, because this is the

first application for a triple round robin tournament, they introduced a number of new constraints.

### **2.2.3 Some Other European Countries League**

Seasonal schedules for sports leagues are subject to a wide range of often conflicting interests coming from teams, television networks, spectators and the association arranging the tournament. This makes the problem of designing solution methods which are capable of handling these constraints - an interesting and challenging task seen from operations research perspective. Furthermore, effective methods are very attractive, since the turnover coming from TV rights and spectators may be highly dependent on the number of requirements being satisfied. This has led to a significant amount of research dealing with practical applications. Bartsch, Drexl and Kröger [7] have scheduled the Austrian and German soccer leagues, Croce and Oliveri [8] have scheduled the Italian soccer league and Schreuder [9] has scheduled the Dutch soccer league.

## ***2.3 Football League Scheduling in South America***

### **2.3.1 Brazilian League**

Professional leagues of soccer and other sports are big businesses and a major economic activity around the world especially in South America. The Brazilian national soccer tournament consists of stronger teams, has much larger attendance and draws more attention from TV audiences. Due to the importance of soccer in Brazil, fair and balanced fixtures for all teams are a major issue for attractiveness and confidence in the outcome. Thus, the importance of having a strong schedule of games is not arguable and many scheduling systems have been developed [10]. Since one of the systems is developed during the 2010 FIFA World Cup, very few dates were available for matches, and the duration of the tournament will be much shorter than in previous years. As a result, there will be more midweek rounds and fewer weekend rounds making it harder to find feasible fixtures. However, the system has one additional nice feature that its capability to indicate to the user the constraints that should be dropped in case of infeasibilities.

### **2.3.2 Chilean League**

Another recent and successful application is the system developed by the Association of National Football Professional (ANFP) in Chile to schedule the tournaments of its soccer professional leagues [11], aiming to provide lower costs and higher incomes to the teams, as well as to increase attendance and attractiveness of the tournaments.

### **2.4 Football League Scheduling in North America**

There was also a study whose intention was to investigate the issue of days off between games within a professional sports league. As per the study, a potential source of inequity within a professional sports league and football leagues could occur when Team A and Team B are scheduled to play one another on a specific day, yet Team A has fewer “days off” prior to this game than does Team B. Therefore, the “marginal days rest” (the difference in days off for Team A and Team B) may have an impact on team performance. This could provide an additional perspective whether the number of days off between games truly matters in the outcome of professional sports. The study explored that the number of days off experienced by a team between games impacts the team performance and recommends a better scheduling system to be implemented in the future that considers this aspect as a constraint [12].

### **2.5 South African League**

South African league (Premier Soccer league (PSL)) is contested along European lines, starting in August and concluding in May of the following year with 16 teams fighting for the title every season. The league uses soccer software which calculates fixture lists for league consisting of 4 to 24 teams in only a few minutes, allows for the appointment of match officials and allows the user to create league tables [13, 14].

### **2.6 Seat Reservation System**

Massive events, as sportive events, involve a huge amount of spectators. Citizens that wish to attend events buy tickets that allow them to seat in a given zone of the stadium with several features, but usually they do not buy the physical seat at the sport ground. Then, one of the duties of the organizing committees is to allocate the different localities of the enclosure to the persons

who have bought tickets. In the seat allocation process, the ticket category, groups, ranks, distribution rules and many other factors should be taken into account.

In [15] a methodology was presented to deal with the seat allocation problem for massive events. In such kind of problems, groups of tickets with very different attributes (categories, ranks, and status) should be assigned to stadium seat zones, characterized also by categories, ranks, size, etc. In addition, the organizing committee imposes some distribution rules that should be satisfied in some cases and optimized in other ones.

[16] Presents a seat reservation system which was first launched in 2008 and installed at Arsenal FC (One Premiership club in England) whose objective was to enhance customer experience and it provides the following features:

- takes away the need for face-to-face appointments for both season ticket renewals and new applicants
- allows login and viewing the seats made available by Arsenal FC at the appointment time.
- offers views from all 60,000 seats held in the system.

## ***2.7 Lessons Learned***

The preceding sections reviewed a number of systems on the scheduling of the national soccer league of various countries. However, because of some specific constraints that characterize each of these competitions, the models presented in those studies are not readily applicable to soccer league scheduling problems in Ethiopia. There are many constraints that characterize Ethiopian Leagues only. For instance:- unlike other countries leagues, many Ethiopian clubs are using a single stadium, all regional stadiums do not have Electric power so that no 12 o'clock(local time) match can be conducted and other competition and discipline rules are different for Ethiopian leagues. Therefore, we are forced to develop a new system for the Ethiopian Premier and Bherawi Leagues which satisfies the constraints specified by the Ethiopian Football Federation.

## Chapter Three: Requirements

### 3.1 Functional Requirements

The system will provide the following functions:

- Enable the secretary to register stadiums, clubs, players, referees and commissionaires.
- Notify the secretary of different violations during registration of clubs and players registration.
- Allow the secretary to modify and update data related with stadiums, clubs, players, referees and commissionaires.
- Enable the scheduler to automatically generate schedules of the competition.
- Enable the scheduler and/or referees to register match statistics.
- Enable the scheduler to assign referees and commissioners for the matches.
- Notify the scheduler of different violations during registration of match statistics.
- Enable the scheduler to modify and update data related with matches.
- Generate different types of reports:
  - Match fixtures
  - Match results and goal scorers
  - The League table
  - Conduct (Cautioned and red carded players)
  - Top goal scorers of the league
  - Financial penalties to be imposed on players and/or clubs
  - Seat reservation (for A.A stadium matches)
  - Fan attendance(for A.A stadium matches)
  - Total amount of money earned from the match (for A.A stadium matches)
- Allow the fan to reserve for free a seat in A.A stadium
- Allow the fan, the clubs and the media to get information about the Premier and Bherawi Leagues.
- Produce a receipt when customer buys a ticket.
- Maintain information about seats (the number of customers registered (fan attendance) and reservation date).

## **3.2 Non Functional Requirements**

### **3.2.1 User Interface**

- The system will have graphical user interface through which the users interact with the system.
- The interface should be simple, easy-to-learn and clear to make transactions and does not require extensive explanation.

### **3.2.2 Quality Issue**

The system must be reliable in the sense that it should meet the test criteria above 80 percent. Some of the testing **criteria are** listed in Chapter six.

### **3.2.3 Security Issue**

Access to the central database should be controlled and the system shall grant access to users based on actors' roles.

- The system shall permit only the administrator who is authorized to create/edit user's account.
- The administrator, the scheduler, the referee, the commissioner, the secretary and the cashier shall be required to login to EFF-PBLMS for all operations.
- Only the administrator is authorized to postpone match date and time, to generate any kind of reports and to do all operations of the system.
- Only the secretary is authorized to do any kind of registration in the system.
- Only the referee/commissioner is authorized to fill match statistics.
- Only scheduler is authorized to generate schedule for the season.
- The system shall permit the cashier to prepare ticket for customers.

### **3.2.4 Error Handling**

Appropriate error messages will be displayed when a user attempts to undergo unauthorized operation.

### **3.3 System Models**

#### **3.3.1 Use Case Model**

##### **A. Actors**

**Customer:** a person who visits the web for seat reservation or for viewing information.

This may include the media, the fans and any person who is interested to surf the federation's website.

**Cashier:** a person who prepares bill statement for the customer.

**Secretary:** a person who does tasks related to registration.

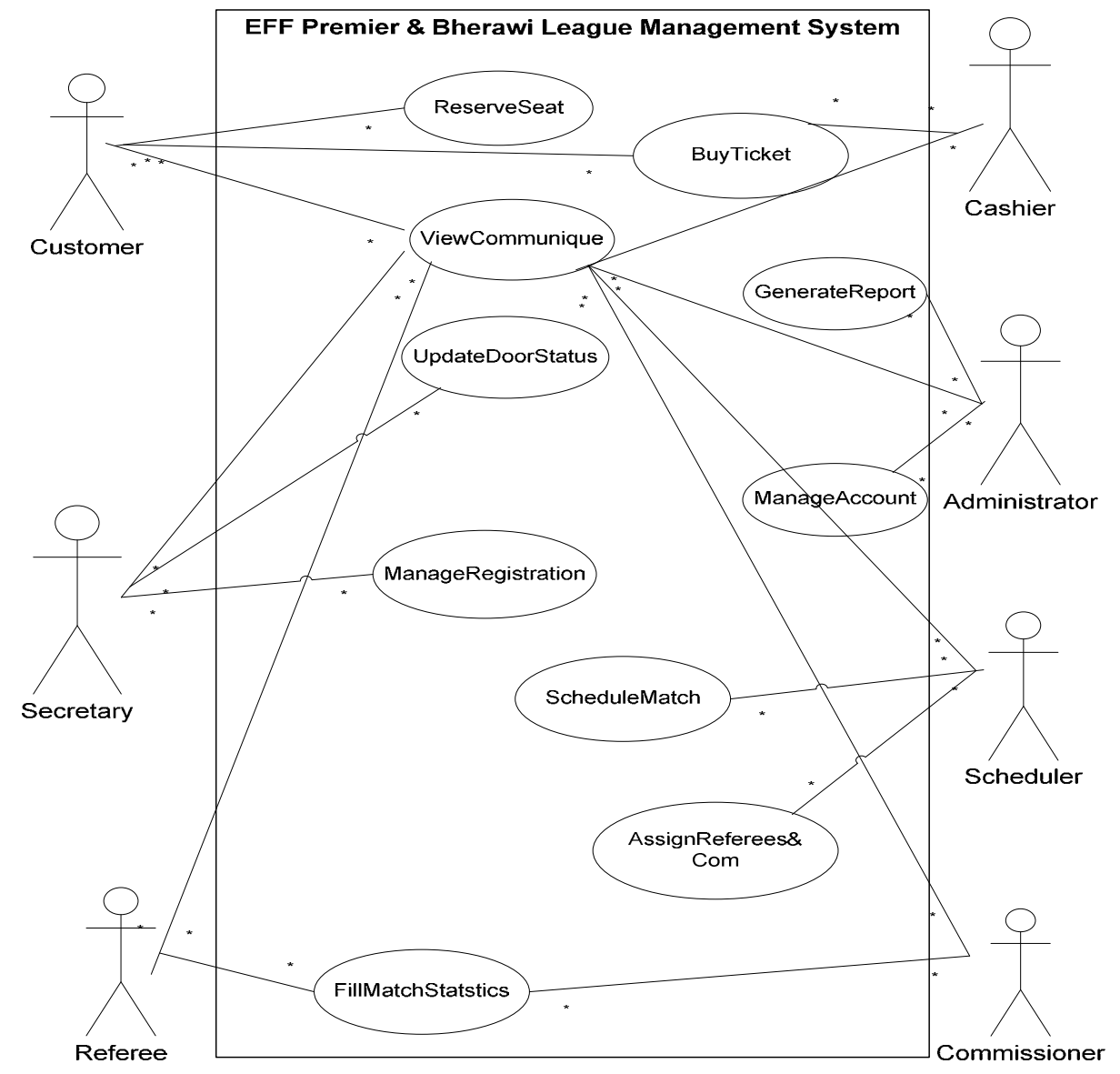
**Scheduler:** a person who schedules matches and assigns referees and commissioners.

**Referee:** A person who fills in match statistics form.

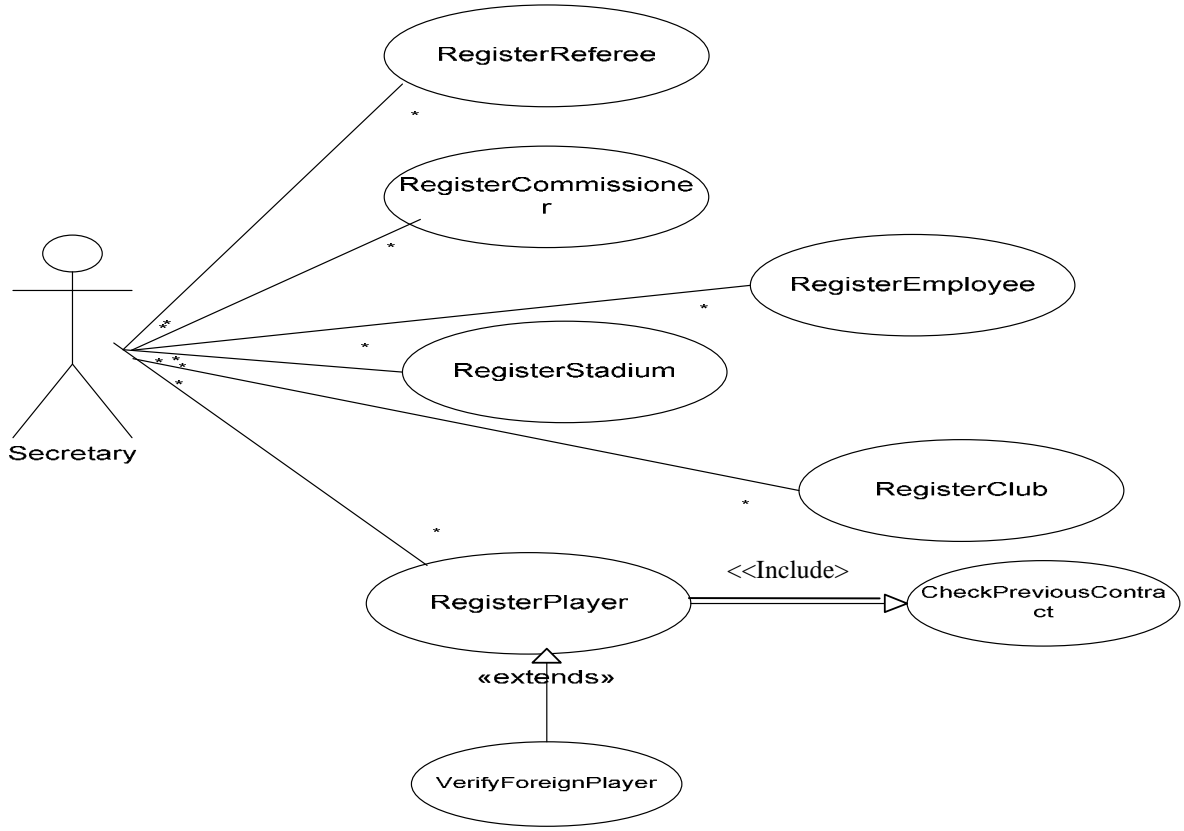
**Commissioner:** a person who oversees the game while it is conducted and fills in match statistics form.

**Administrator:** a person who controls the overall system.

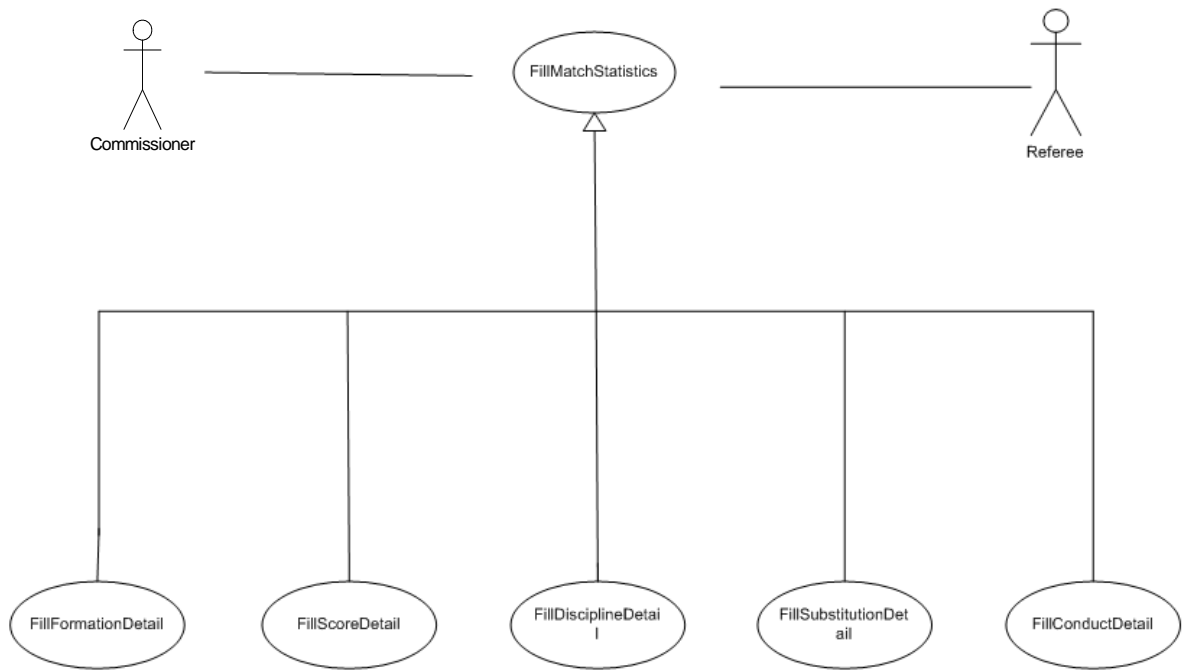
## B. Use Case Diagram



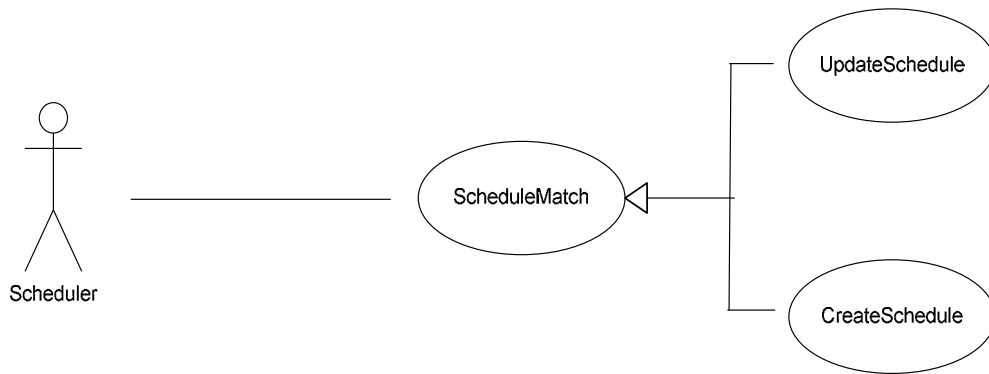
*Figure 3.1 Use Case Diagram of the EFF-PBLMS*



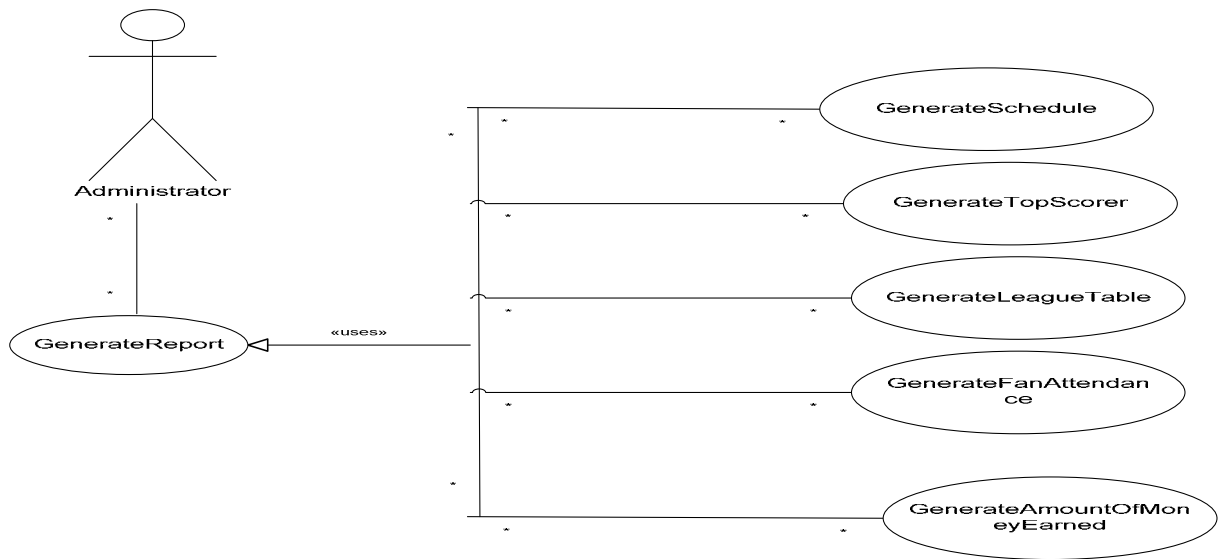
**Figure 3.2** *ManageRegistration Use Case*



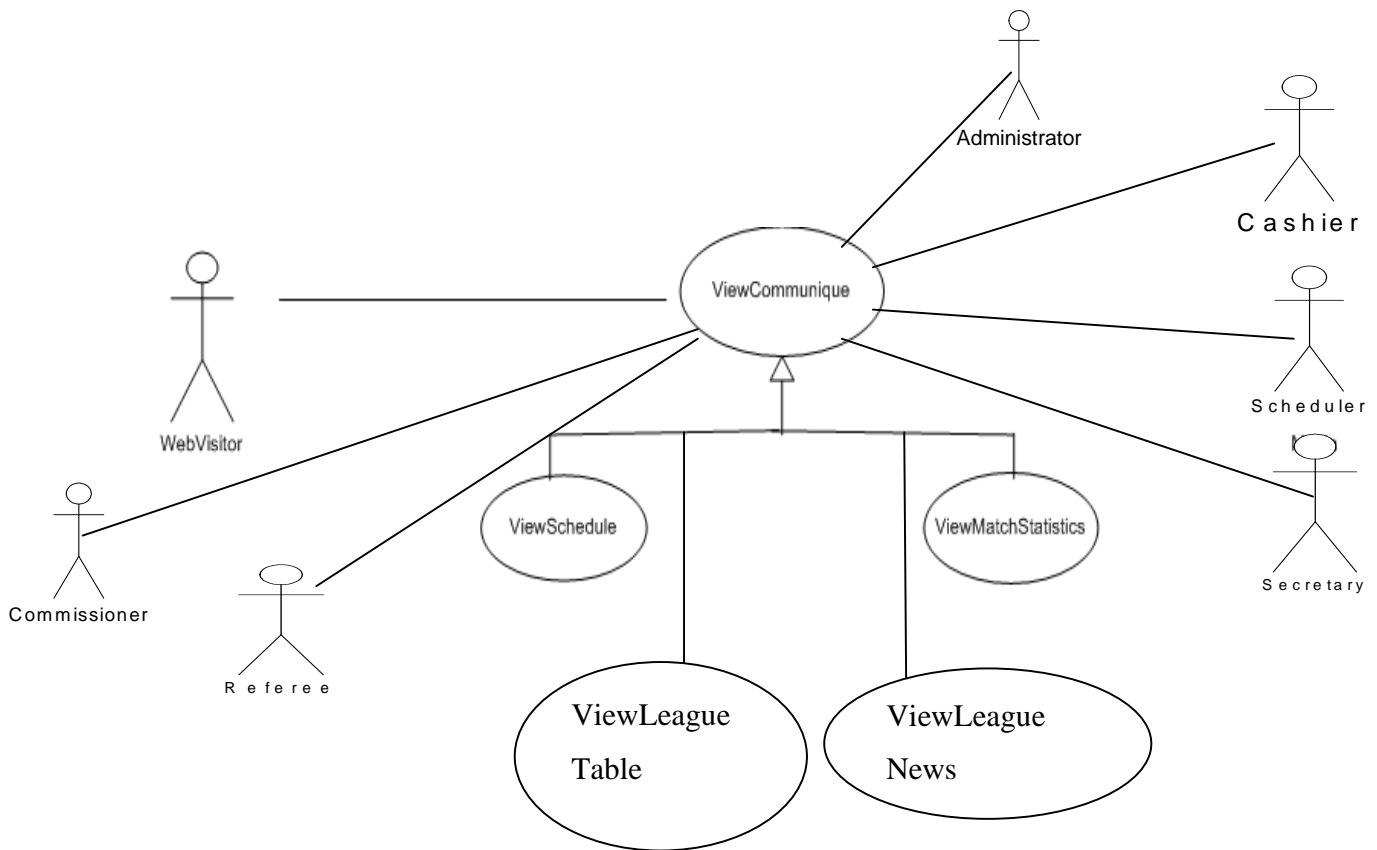
**Figure 3.3 FillMatchStatistics Use Case**



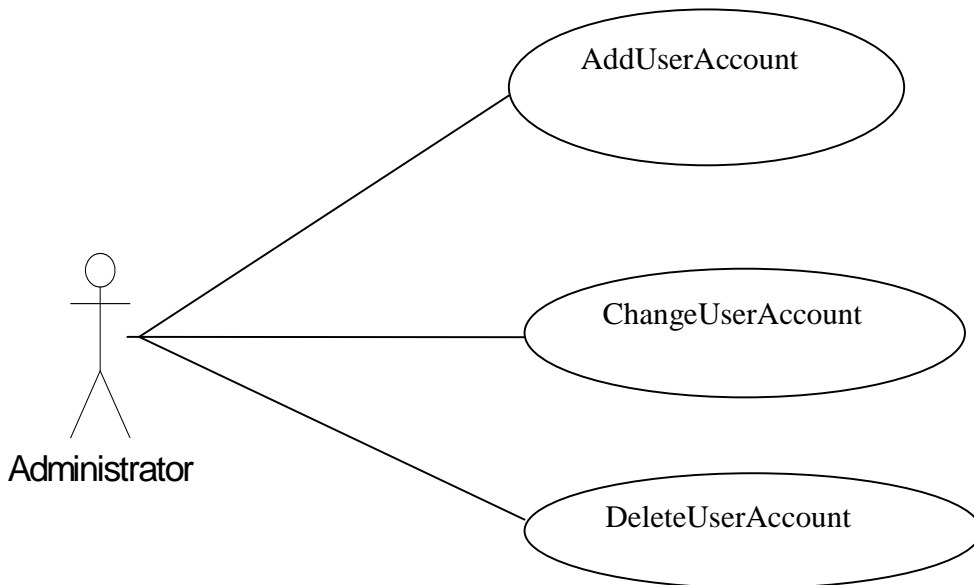
**Figure 3.4 ScheduleMatch Use Case**



**Figure 3.5 GenerateReport Use Case**



**Figure 3.6 ViewCommunique Use Case**



*Figure 3.7 ManageAccount Use Case*

### C. Use case Description

#### 1. Use case Name: BuyTicket

**Actors:** Customer, Cashier

**Description:** allow the customer to buy ticket

**Precondition:** the cashier must login to the system

**Flow of Events:**

1. The customer asks a seat for a specific match. [Alternate 1]
2. The cashier uses the system to check and tell available seat in the specific door of the stadium. [Alternate 2]
3. The customer pays the money.
4. The cashier clicks on Buy button.
5. The system prints the receipt.

**Alternate Flow 1** [if the customer has already reserved the seat in the specific door]

- 1.1 The customer tells his/her name to the cashier.

1.2 The cashier clicks on Search button to check.

1.3 The system displays the customer's information. [Alternate 1.1]

1.4 Use case starts from step 3.

**Alternate Flow 1.1** [if the customer name does not exist]

1.1.1 The system displays that the name is not available.

1.1.2 The cashier clicks on Close button and exits from the system.

**Alternate Flow 2** [if the seat is full in the specific door]

2.1 The system displays that there is no available seat at the requested door.

2.2 The cashier clicks on Close button and exits from the system.

**Post condition:** ticket is prepared and the information is recorded in the database.

**2. Use Case Name:** ReserveSeat

**Actors:** Customer

**Description:** allow the customer to reserve seat.

**Precondition:** None.

**Flow of Events:**

1. The customer requests for reservation.
2. The system displays a reservation form.
3. The customer fills in the reservation form and submits.[Alternate 1]

**Post Condition:** the customer reserved the seat.

**Alternate Flow 1** [if there is no available seat]

1.1 The system informs that there is no available seat for reservation and resets the values to empty.

**3. Use Case Name:** UpdateDoorStatus

**Actor:** Administrator

**Description:** Allow the administrator to update the door status (updating seat price, number of seats etc).

**Precondition:** Administrator should log in.

**Flow of Events:**

1. Administrator initiates the "UpdateDoorStatus" use case.
2. The system displays the Update DoorStatus Form which has door price and amount of seats in the door.

3. The administrator fills in and submits.
4. The system acknowledges.

**Post Condition:** A Door status is updated.

**4. Use Case Name:** AddUserAccount

**Actor:** Administrator

**Description:** Allow the administrator to add accounts.

**Precondition:** Administrator should log in.

**Flow of Events:**

1. The administrator initiates “Add User Accounts” use case.
2. The system displays the Create User form.
3. The administrator fills in the details of the new user and submits
4. The system checks the information filled and acknowledges. [Alternate 1]

**Post Condition:** The account will be added.

**Alternate Flow 1** [if the administrator fills the existed user name]

- 1.1 The system displays the wrong message dialogue and resets the values to empty.

**5. Use Case Name:** ChangeUserAccount

**Actor:** Administrator

**Description:** Allow the administrator to change accounts.

**Precondition:** Administrator should log in.

**Flow of Events:**

1. The administrator initiates “Change User Accounts” use case.
2. The system displays the Change Account form.
3. The administrator selects the account to be changed.
4. The administrator presses Change Name or Change Password button.
5. The system displays a new form to enter new name or password.
6. The administrator fills in the form and submits.[Alternate 1]
7. The system updates the database.

**Post Condition:** The account will be changed.

**Alternate Flow 1** [if the administrator fills the existed user name]

1.1 The system displays the wrong message dialogue and resets the values to empty.

**6. Use Case Name:** DeleteUserAccount

**Actor:** Administrator

**Description:** Allow the administrator to delete accounts.

**Precondition:** Administrator should log in.

**Flow of Events:**

1. The administrator initiates “Delete User Accounts” use case.
2. The system displays the Delete Account form.
3. The administrator selects the account to be deleted.
4. The administrator presses delete button.
5. The system removes the account from the list.

**Post Condition:** The account will be deleted.

**7. Use Case Name:** RegisterEmployee

**Actors:** Secretary

**Description:** To allow the general secretary to register employees of the system.

**Precondition:** The secretary should login.

**Flow of events:**

1. The General Secretary initiates the registration.
2. The system responds by displaying the employee registration form.
3. The General Secretary fills in the form and submits.
4. The system validates that required fields are appropriately filled and notifies the General Secretary of the employee's registration.

**Post Condition:** New employee is registered.

**8. Use Case Name:** RegisterStadium

**Actor:** Secretary

**Description:** To allow the general secretary to register stadiums.

**Precondition:** The secretary should login.

**Flow of Events:**

1. The General Secretary initiates the registration.
2. The system responds by displaying the stadium registration form.

3. The General Secretary fills in the form and submits.
4. The system validates that required fields are appropriately filled and notifies the General Secretary of the stadium's registration.

**Post Condition:** new stadium is registered.

#### 9. Use Case Name: RegisterClub

**Actor:** Secretary

**Description:** To allow the general secretary to register clubs.

**Precondition:** The general secretary should provide a unique receipt number.

**Flow of Events:**

1. The General Secretary initiates the registration.
2. The system responds by displaying the club registration form.
3. The General Secretary fills in the form and submits [Alternate 1].
4. The system notifies the General Secretary of the club's registration.

**Post Condition:** new club is registered.

**Alternate Flow 1** [if The Jersey colour selected by a club has already been assigned to another club. ]

- 1.1 The system resets the Jersey colour field to empty and prompts for another colour.
- 1.2 The General Secretary selects a different colour.
- 1.3 Step 4 in the Basic Flow is then executed.

#### 10. Use Case Name: RegisterCommissioner

**Actor:** Secretary

**Description:** To allow the general secretary to register commissioners.

**Precondition:** The secretary should login.

**Flow of Events:**

1. The General Secretary initiates the registration.
2. The system responds by displaying the commissioner registration form.
3. The General Secretary fills in the form and submits the form.
4. The system validates that required fields are appropriately filled and notifies the General Secretary of the commissioner's registration.

**Post Condition:** new commissioner is registered.

## 11. Use Case Name: RegisterReferee

**Actor:** Secretary

**Description:** To allow the general secretary to register referees.

**Precondition:** The secretary should login.

**Flow of Events:**

1. The General Secretary initiates the registration.
2. The system responds by displaying the referee registration form.
3. The General Secretary fills in the form and submits the form.
4. The system validates that required fields are appropriately filled and notifies the General Secretary of the referee's registration.

**Post Condition:** new referee is registered.

## 12. Use Case Name: RegisterPlayer

**Actor:** Secretary

**Description:** To allow the general secretary to register players.

**Related Use Cases:** CheckPreviousContract (include relationship), VerifyForeignPlayer  
(extend relationship)

**Precondition:** The secretary should login.

**Flow of Events:**

1. The General Secretary initiates the registration.
2. The system responds by requesting club name for which the present player is to be registered for.
3. The user provides the club name.
4. The system checks total number of players in the given club, then displays the player registration form.[Alternate 1].
5. The user completes and submits the form [Alternate 2].

**Post Condition:** New player is registered.

**Alternate Flow 1** [if the player is the 31st player being registered]

- 1.1 The system notifies the secretary of the violation.
- 1.2 The system resets values to empty.
- 1.3 The system disables the player registration form.

**Alternate Flow 2** [if the player being registered is the 26th player of age greater than

17 Or he is the 6th player of age less or equal to 17]

- 1.1 The General Secretary is notified of the age composition violation instigated by the registration of the current player.
- 1.2 The General Secretary prints the notification and exits.
- 1.3 The system removes the data of the current player which caused the violation.

### **13. Use Case Name:** VerifyForeignPlayer

**Actor:** Secretary

**Description:** To allow the general secretary to register foreign players.

**Precondition:** The player to be registered has to be a foreigner. (The secretary has to select the foreigner option)

**Base use case:** RegisterPlayer

**Flow of Events:**

1. The system displays additional fields to be filled by the user.
2. The General Secretary fills visa expiration date, work permit, and residence permit information. [Alternate 1].

**Post Condition:** The system updates the player and Foreign player registration tables.

**Alternate Flow 1** [if the visa or work permit of the player is not valid]

- 1.1 The system resets the values inserted by the user
- 1.2 The General Secretary is notified of the violation.

### **14. Use Case Name:** CheckPreviousContract

**Actor:** Secretary

**Description:** To allow the general secretary to keep records of fines resulting from contract violation by players.

**Precondition:** The player being registered has a prior contract with a different club that has not expired.

**Base use case:** RegisterPlayer

**Flow of Events:**

1. The system checks if there is uncompleted contract by the player and notifies the secretary if there is contract violation and displays a fine form.
2. The General Secretary provides the fine amount and submits the form.

3. The system confirms that the fine is registered.

**Post Condition:** The system updates the contract fine and contract tables.

**15. Use Case Name:** CreateSchedule

**Actor:** Scheduler

**Description:** To allow the user to prepare match schedule for the entire duration of the competition

**Precondition:** The scheduler should provide a valid competition year.

**Flow of Events:**

1. The user initiates the scheduling.
2. The system displays a form to accept a corresponding lottery number picked by the different clubs.
3. The user fills the lottery numbers and submits the form.
4. The system prepares and displays a schedule for matches to be held throughout the competition. The schedule will display the competing names of competing clubs, match date, time and location.
5. The user confirms and prints the schedule.

**Post Condition:** The system creates a new schedule table for the year with additional field to register results.

**16. Use Case Name:** UpdateSchedule

**Actor:** Scheduler

**Description:** To allow scheduler to modify the schedule by modifying date, time, stadium and commissioner

**Precondition:** The scheduler should have a valid user account.

**Flow of Events:**

1. The user initiates reschedule
2. The system lists the available match schedules
3. The user selects the match schedule to be modified
4. The system prompts the user for modification
5. The user makes the modification and submits the changes.
6. The system commits the changes.

**Post condition-**The system sends a confirmation message to the user.

**17. Use Case Name:** AssignReferees&Commissioners

**Actor:** Scheduler

**Description:** To allow the user to assign referees and commissioners for every match in the entire duration of the competition

**Precondition:** The scheduler should provide a valid competition year and the schedule of the competition has to be generated first.

**Flow of Events:**

1. The user initiates the usecase.
2. The system displays a form to accept a corresponding lottery number picked by the registered referees and commissioners.
3. The user fills the lottery numbers and submits the form.
4. The system prepares and displays a schedule of referees and commissioners for matches to be held throughout the competition. The schedule will display the competing names of competing clubs, match date, time, location and name of the commissioner and referees assigned to each match.
5. The user confirms and prints the schedule.

**Post Condition:** The system creates a new schedule table for the year with the assigned referees and commissioners.

**18. Use Case Name:** fillMatchStatistics

**Actor:** Scheduler, Referee/Commissioner

**Description:** To allow the user to fill data regarding a match conducted

**Precondition:** The user should have a valid user account.

**Flow of Events:**

1. user initiates use case
2. the system displays a match statistics form
3. the user fills in competing clubs, and match number (date)
4. the system displays other related information for the match
5. The user fills in scores of both clubs, names of goal scorers, names of cautioned player with reasons, names of player expelled with the corresponding reasons and submits the form [Alternate 1].

**Post Condition:** the system updates the database

**Alternate Flow 1** [if At least one player in the formation data is under discipline]

1.1 The user is notified of the violation.

1.2 The system prints a notification.

**19. Use Case Name:** GenerateReport

**Actor:** Administrator

**Description:** To generate different types of reports (reports on league table, schedule, match result and scorers, top goal scorers, fan attendance, seat reservation, conduct, financial penalties and amount of money earned)

**Precondition:** None

**Flow of Events:**

1. Administrator activates the “Generate Report” use case.
2. The system displays the Generate Report form and the Administrator enters the report criteria.
3. The system generates report based on the criteria given.
4. The Administrator presses the Print button and the system prints the report.

**Post Condition:** A report is displayed or printed out.

**20. Use Case Name:** viewCommunique

**Actor:** Web Visitor

**Description:** To allow the website visitor to view schedules and match results.

**Precondition:** None

**Flow of Events:**

1. The visitor browses the site and request for viewing information.
2. The system responds by providing lists of available schedules and results

**Post Condition:** The system displayed the site that the user requested.

### 3.3.2 Class Diagram

#### A. Classes

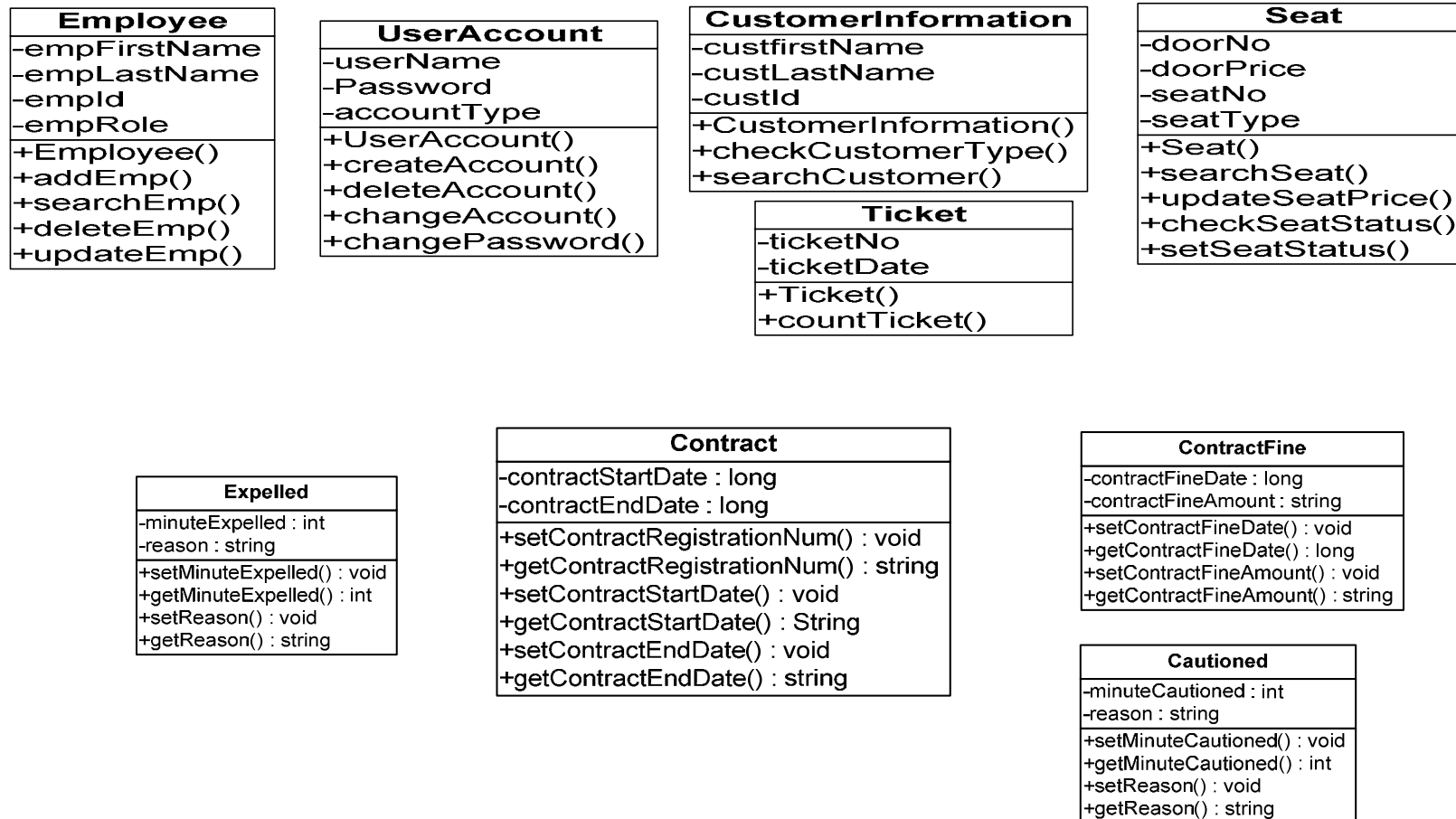


Figure 3.8 Classes of the System

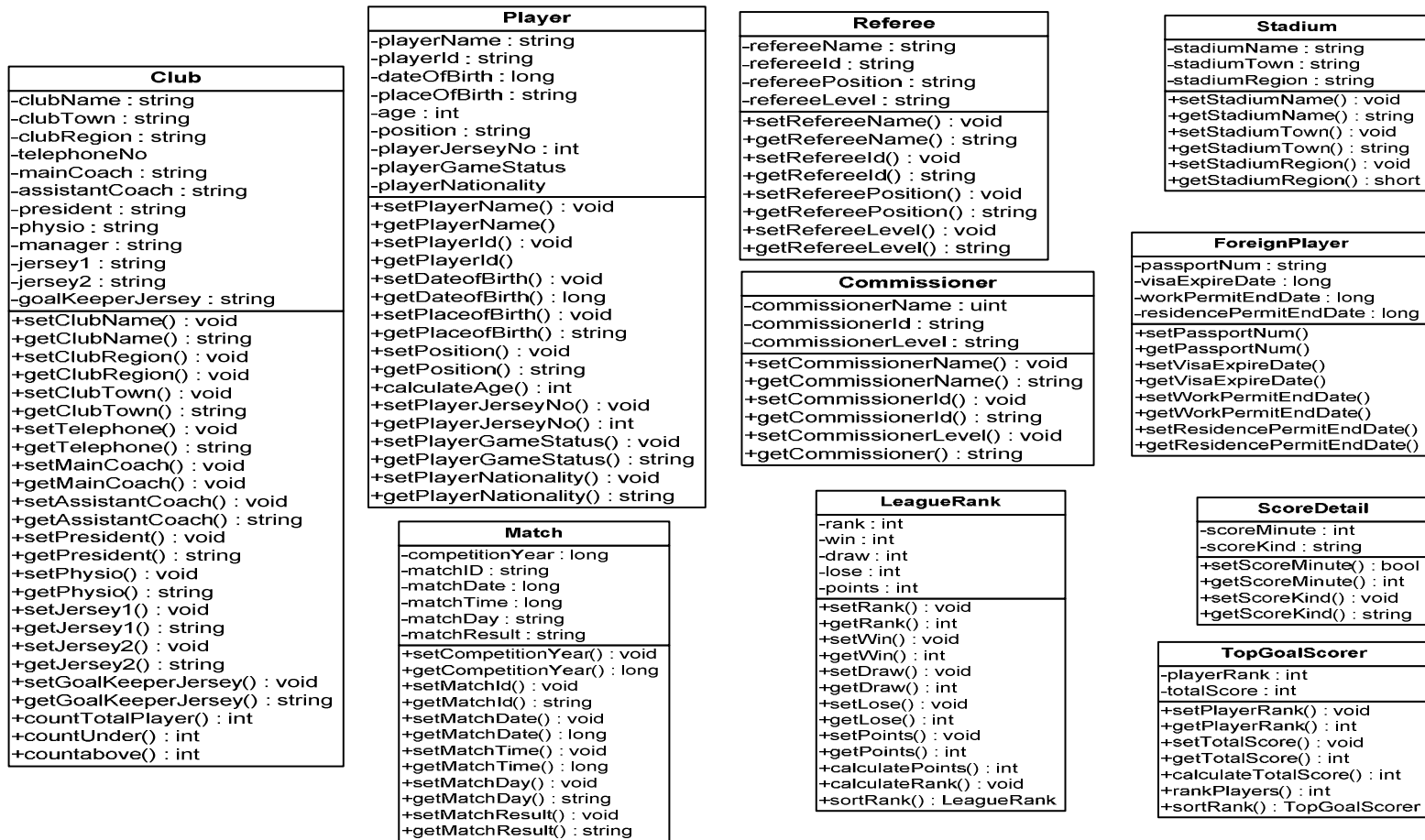


Figure 3.8 (Continued)

## B. Class Diagram

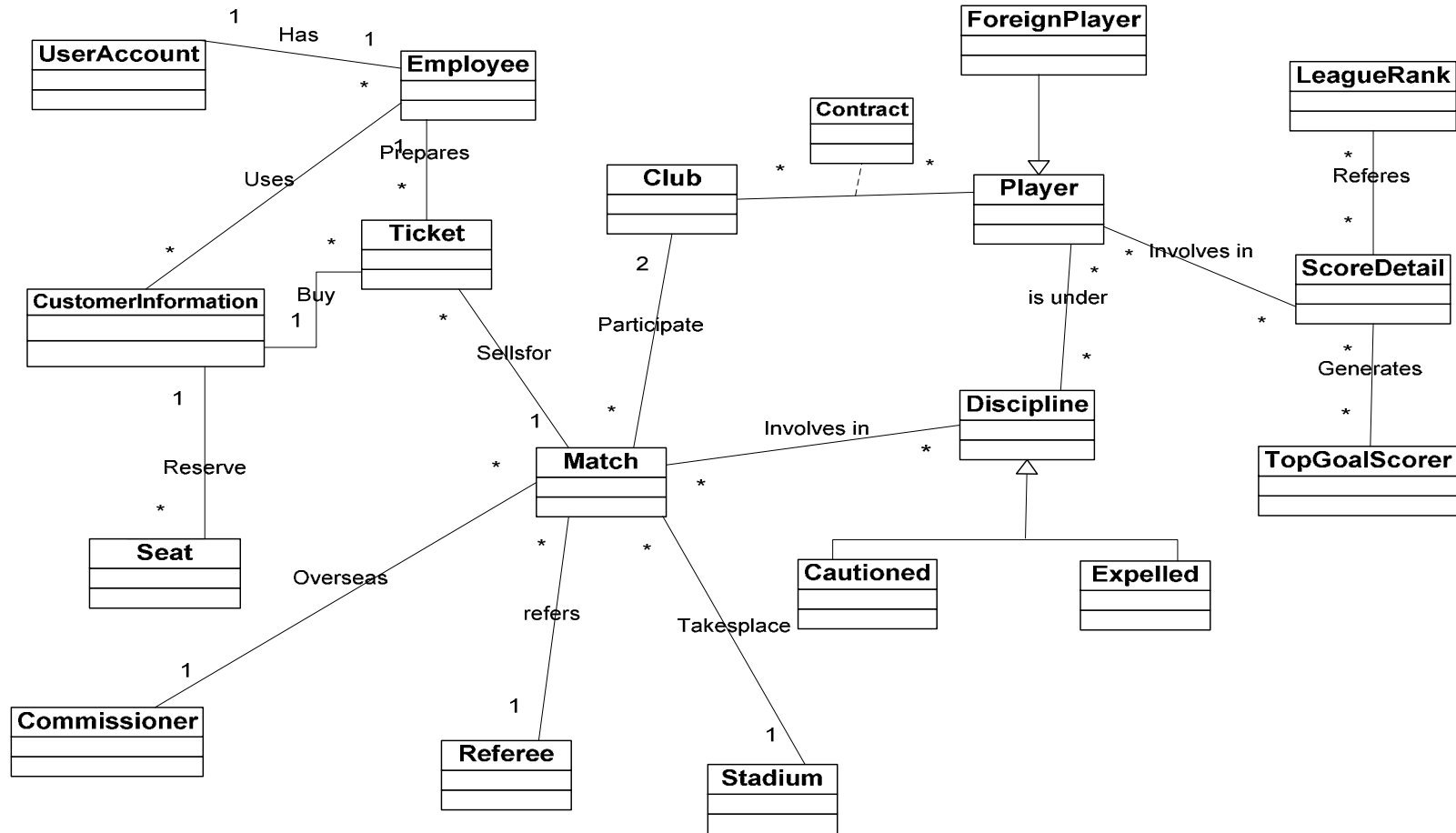


Figure 3.9 Class Diagram of the System

### 3.3.3 Sequence Diagrams

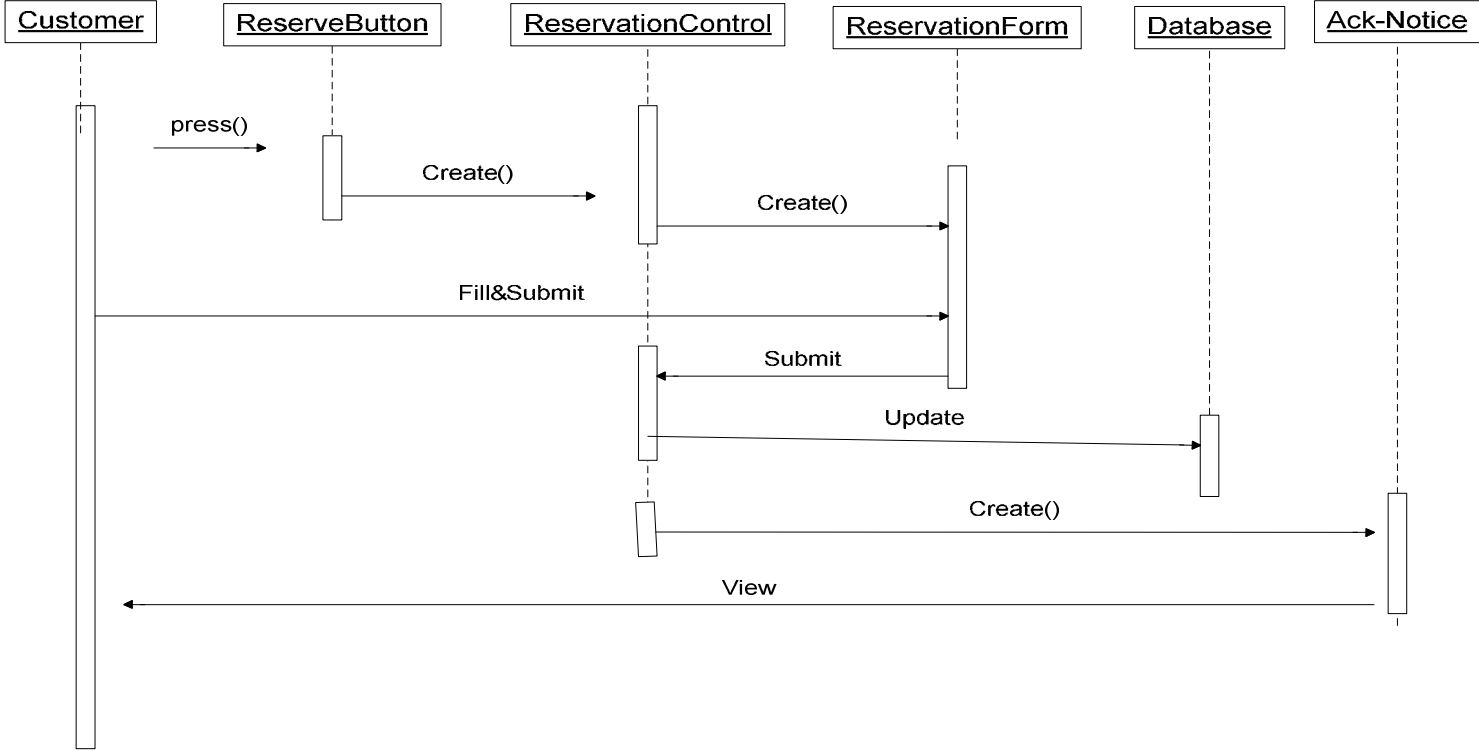
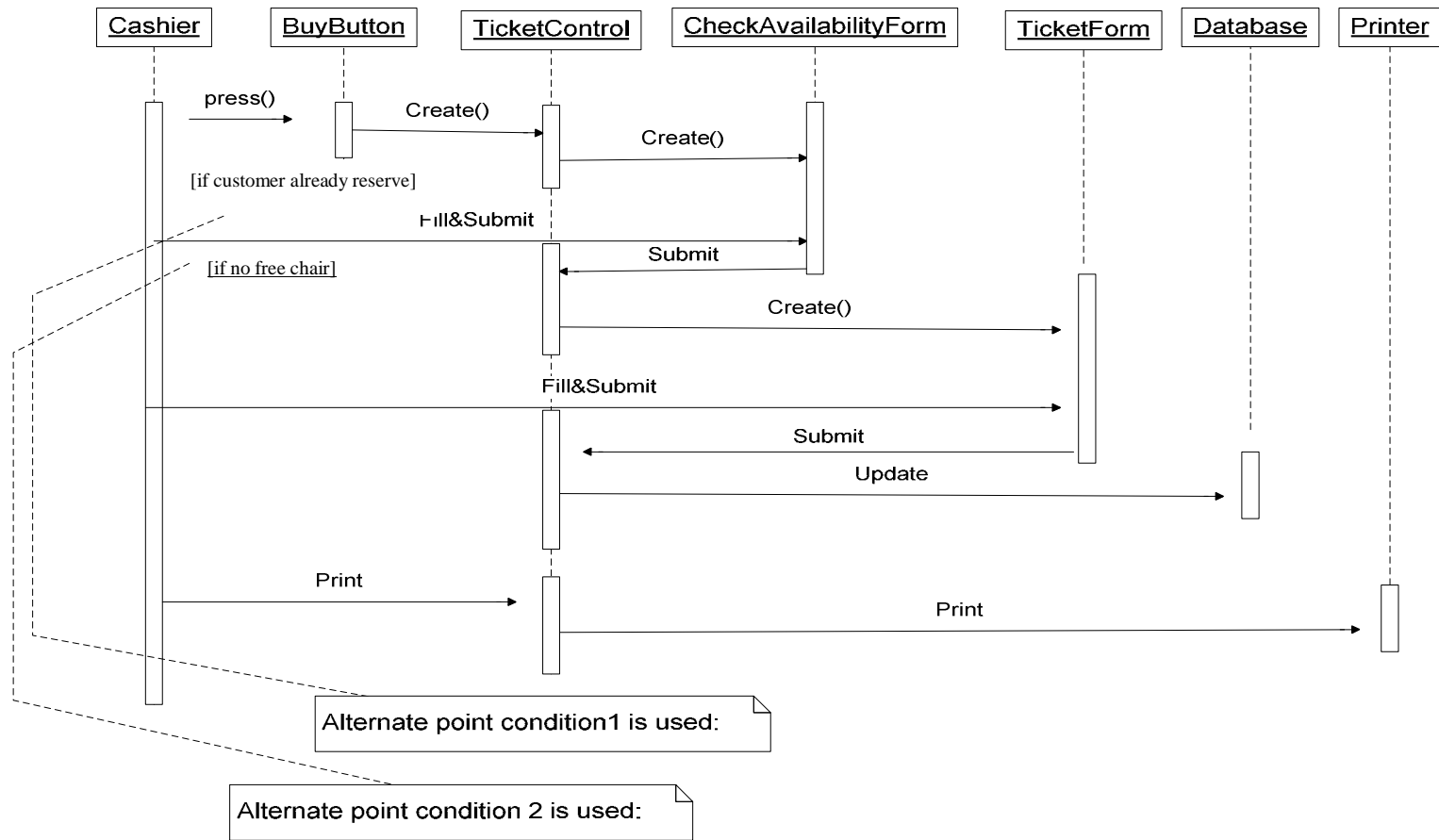
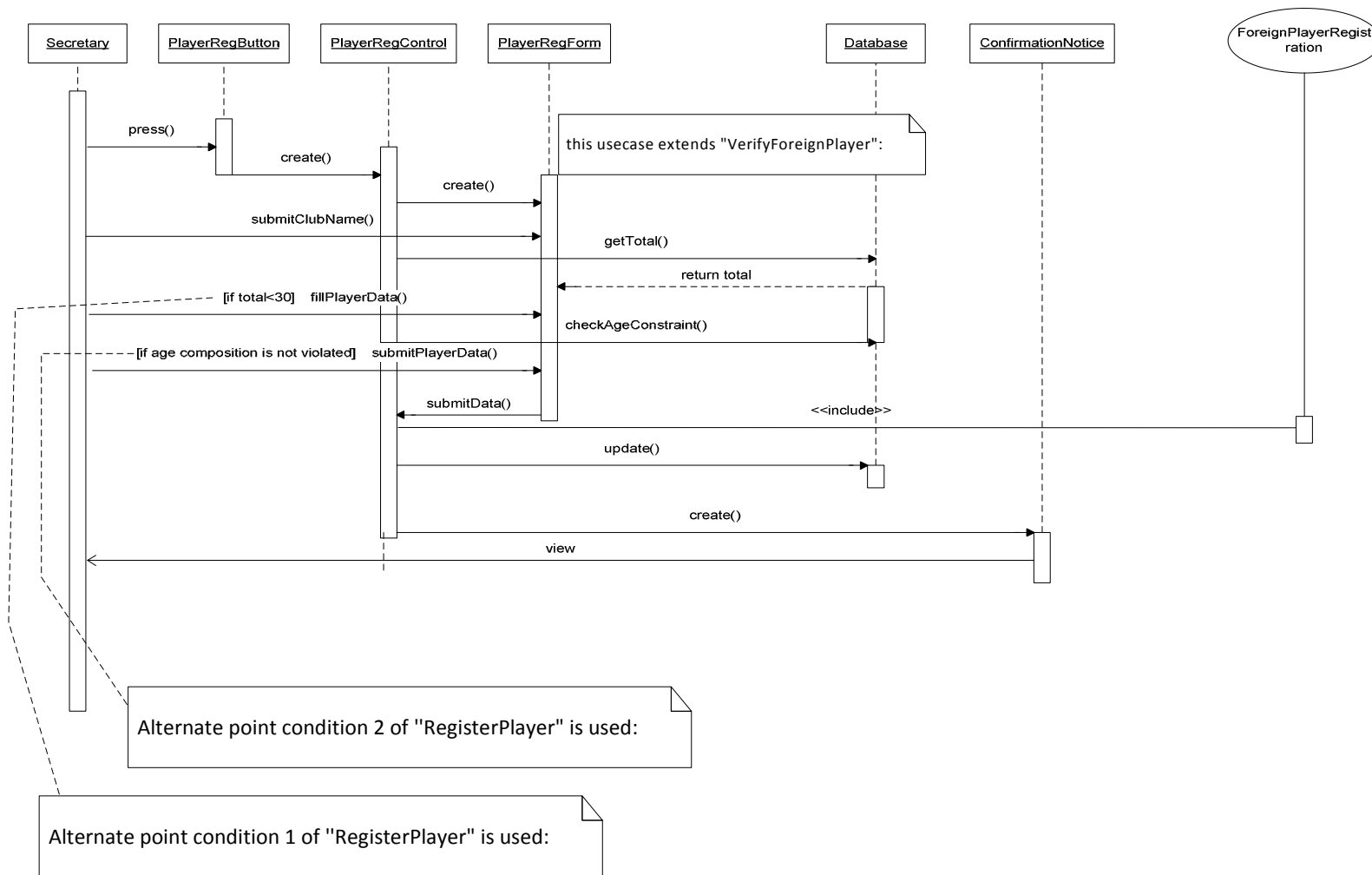


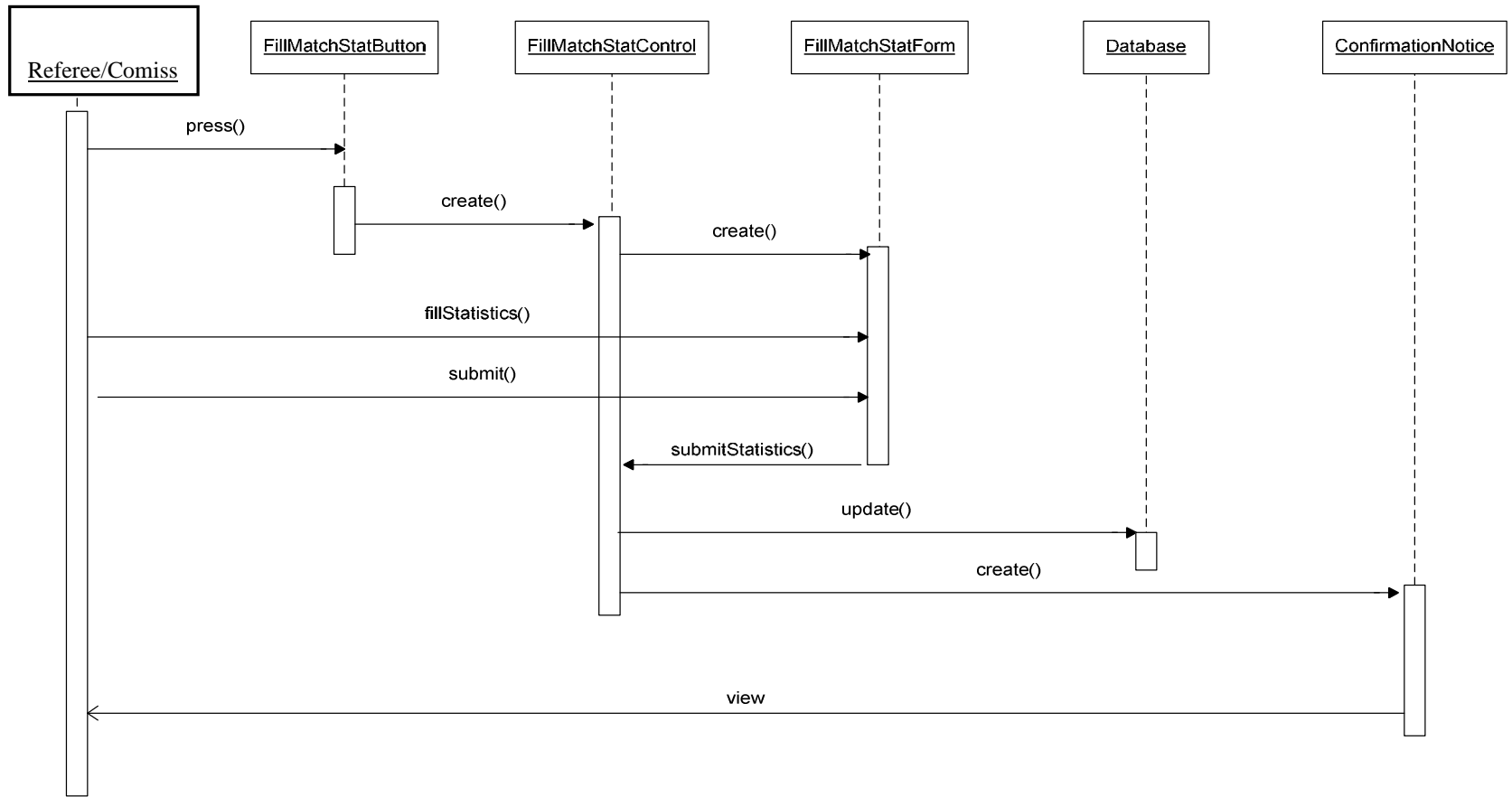
Figure 3.10 Sequence Diagram for ReserveSeat Use Case



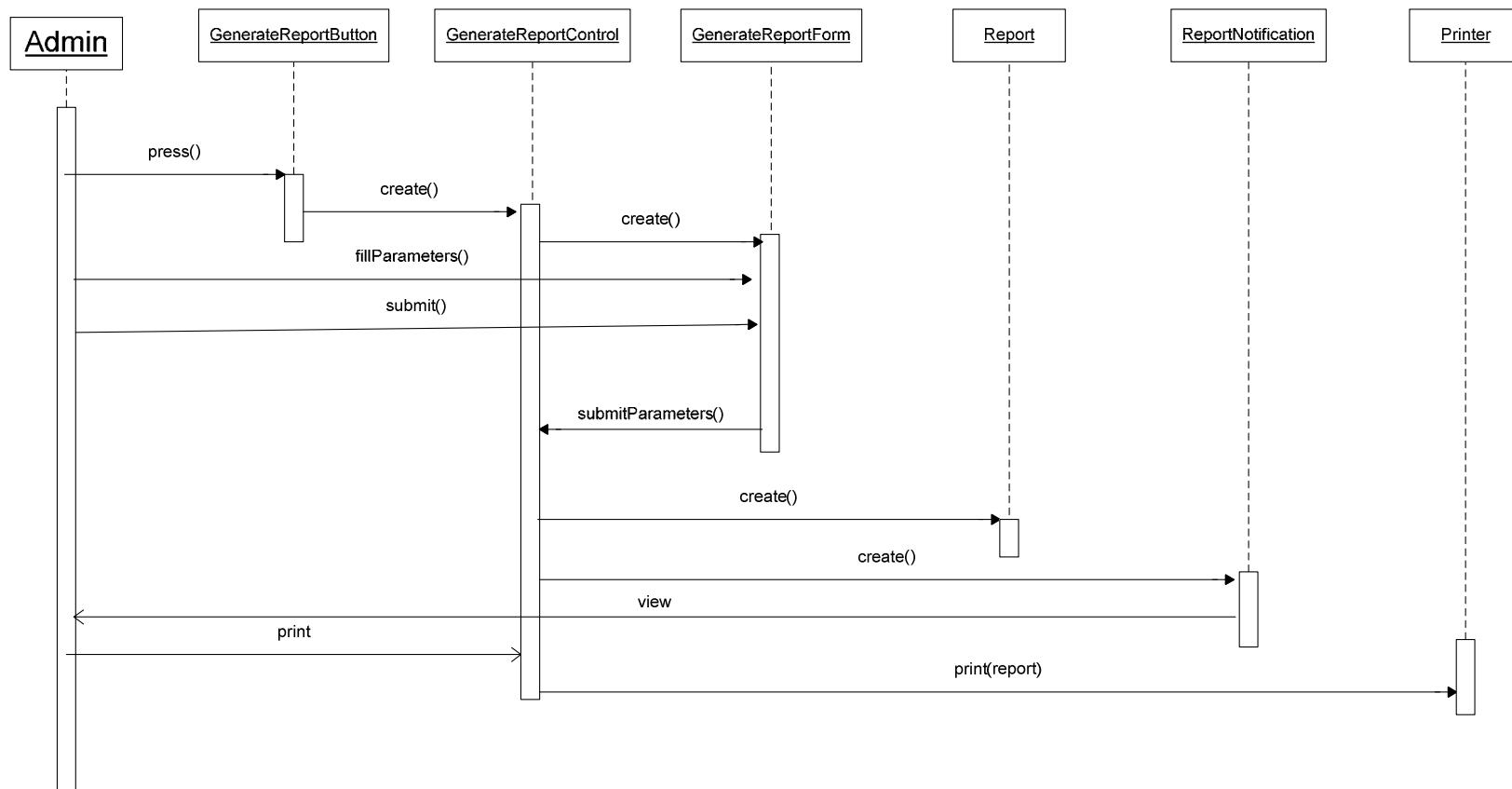
*Figure 3.11 Sequence Diagram for BuyTicket Usecase*



**Figure 3.12 Sequence Diagram for RegisterPlayer Usecase**



*Figure 3.13 Sequence Diagram for FillMatchStatistics Usecase*



*Figure 3.14 Sequence Diagram of Generate Report Usecase*

## Chapter Four: System Design

### **4.1 Overview**

The purpose of the project is to develop simple, fast and secure Premier and Bherawi League Management System for the Ethiopian Football Federation. This Chapter describes the results of system design carried out during design phase of the system development. The first section illustrates the architecture of the system which determines the type of interactions that the components are going to have. The second section which is the most important one describes the system under development in terms of system decomposition, deployment diagram and object to tables mapping.

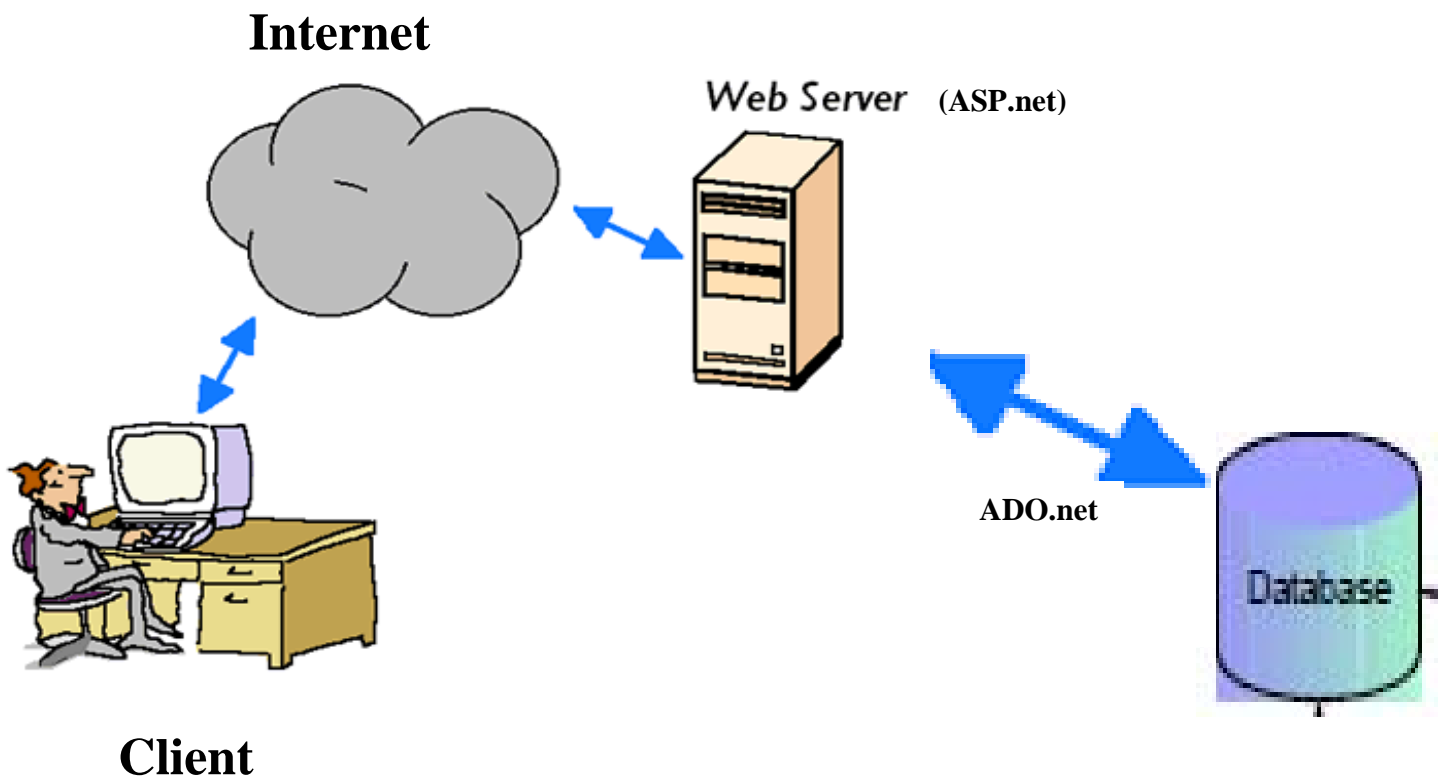
### **4.2 Architecture of the System**

The architecture used for the proposed system is a three-tier Client/Server Architecture, Figure 4.1, where a client can use Internet browsers to access the system within the local area network of the federation or any where using the Internet. In this type of architecture the server is responsible to receive a request from the client and respond to the request, whereas the client is responsible to interact with that of the users of the system.

The data tier maintains the applications data such as player data, club data, customer data etc. It stores these data in a relational database management system. It is also responsible to provide the requested database services to the web server. Generally, it is responsible for modification and insertion of data to the database.

The middle tier is a web/application server which is responsible to receive browsers' request through http protocol and responds accordingly. It controls the interaction between the application's clients and data, processes client requests such as requests to view match result, to fill match statistics or to retrieve data from the database and dictates how clients can and cannot access application data and how applications process data.

The client tier is the application's user interface containing data entry forms and client side applications. Users interact directly with the application through user interface. The client tier interacts with the web/application server to make requests and to retrieve data from the database. Generally, users merely need to start their browsers and enter the URL of the application Web site and then the server hosting the Web site will allocate all the resources the Web application requires.



*Figure 4.1 System Architecture of the Proposed System*

### **4.3 Subsystem Decomposition**

Subsystem decompositions will help to simplify and reduce the complexity of the system. The subsystems can be considered as packages holding related classes/objects. Ethiopian Football Federation Premier and Bherawi League Management System is an aggregate of different smaller components. Each of these components is represented by a subsystem. There are five subsystems, Figure 4.2.

#### **4.3.1 Registration Subsystem**

This sub system is responsible for registering clubs, players, score details, players' disciplines, players' contracts and substitutions in matches.

#### **4.3.2 User Management Subsystem**

This subsystem is responsible for managing the creation, modification and deletion of user accounts.

#### **4.3.3 Reservation Subsystem**

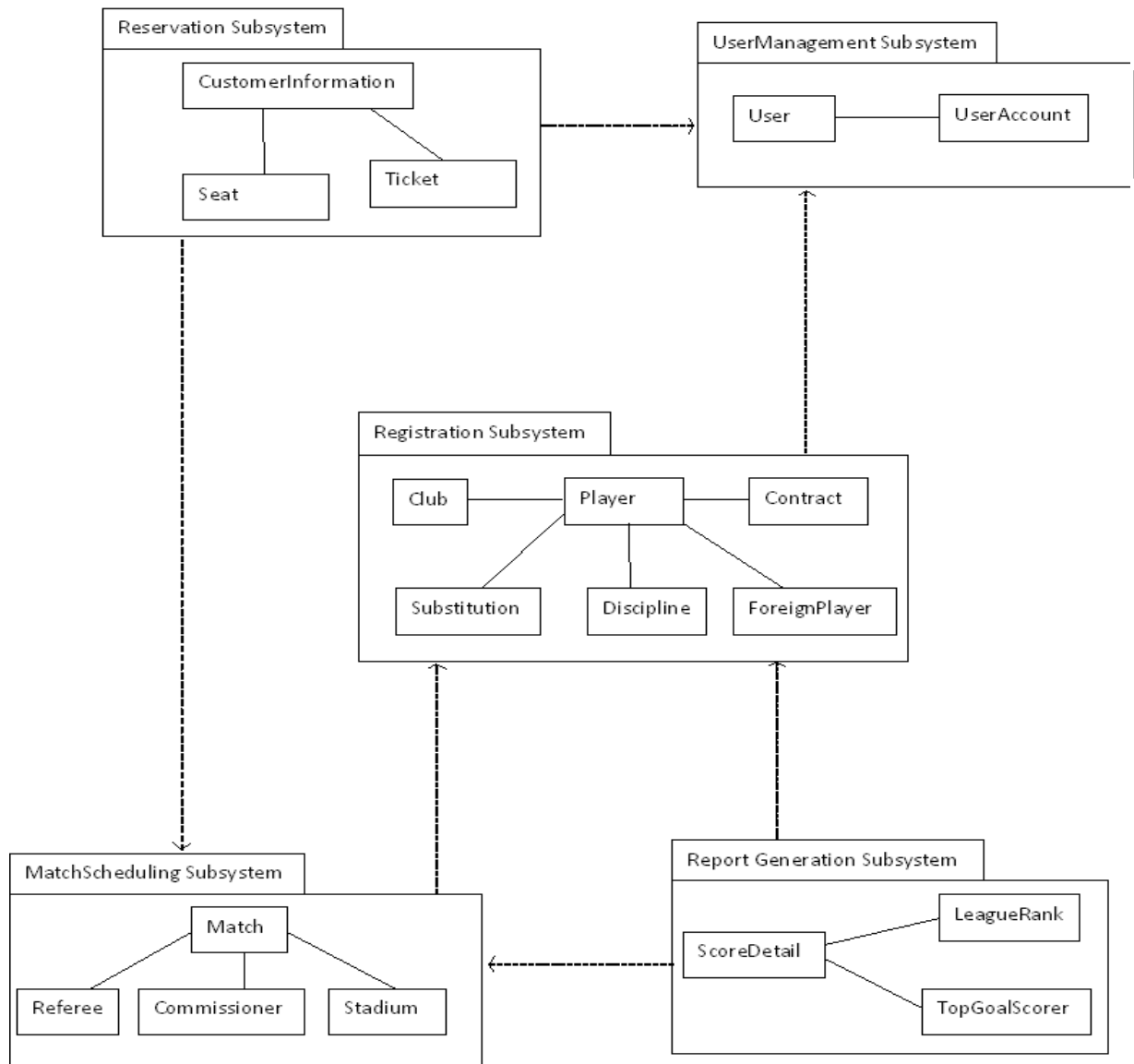
The main responsibility of this subsystem is to deal with seat reservation, ticketing and payment tasks of the system.

#### **4.3.4 Match Scheduling Subsystem**

This subsystem is responsible to take care of generating fixtures and assigning referees and commissioners to the matches.

#### **4.3.5 Report Generation Subsystem**

This subsystem is responsible for generating league table, top goal scorers and reports related to fan attendance.



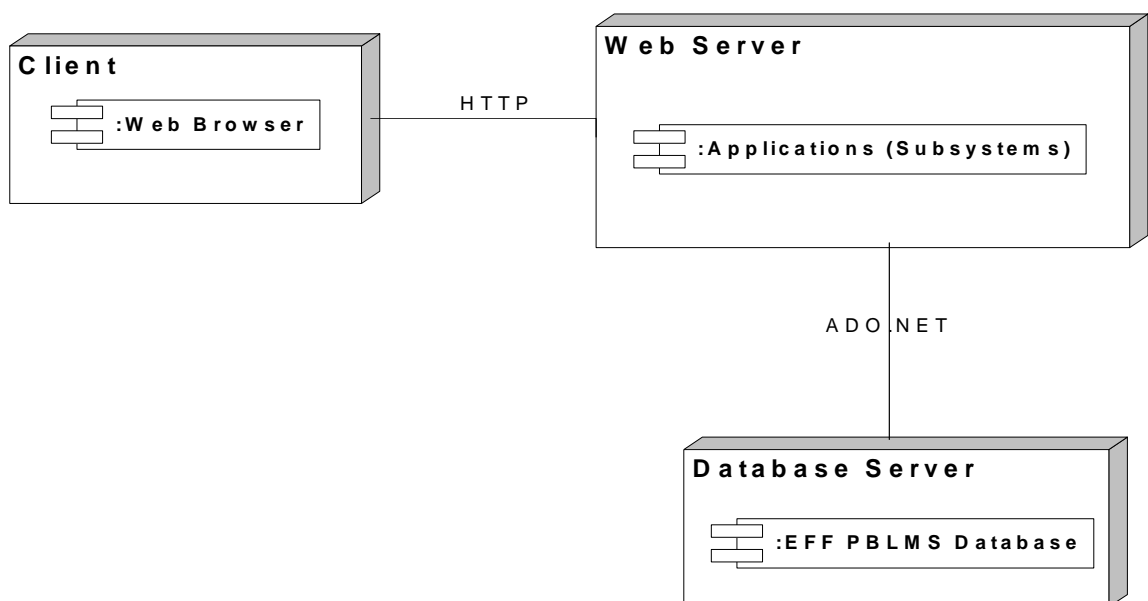
**Figure 4.2** *Subsystem Decomposition Diagram*

## 4.5 Hardware/Software Mapping

### Component Overview

As EFFPNLMS will be built using three-tier client/server architecture, it has three nodes such as the Web server, Database server and Client. The nodes can represent specific instances (workstations) or a class of computers (servers) which are virtual machines. The component at client's node is responsible to browse the application from the server and provide a print service when requested by the user. The component at the server's side is the web server and the database server. The web server is an application program that will be developed using ASP.Net programming language and ADO.Net (ActiveX Data Object) that is responsible both to create a connection and to manage the conversation (request and response) between the application and the database, whereas the database server is implemented by Microsoft SQL server 2005 to maintain the data storage.

Figure 4.3 shows the software and hardware mapping of the Ethiopian Football Federation Premier and Bherawi League Management System.

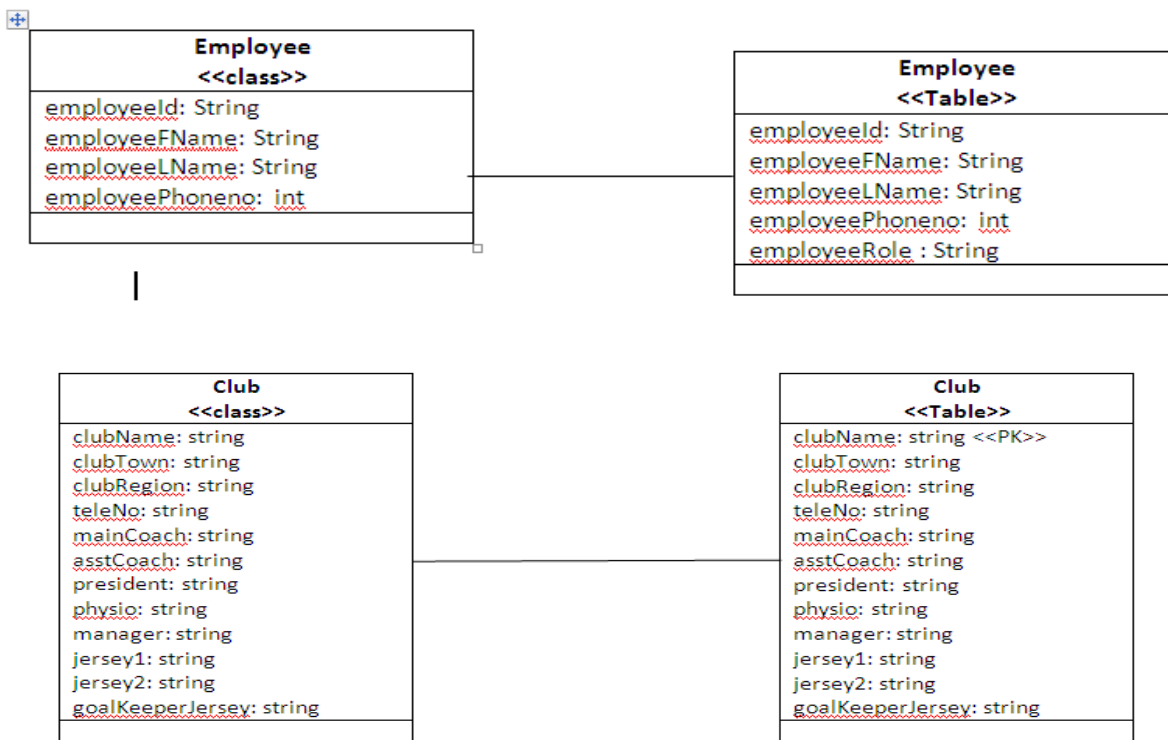


*Figure 4.3 Deployment Diagram of the System*

## 4.6 Persistent Data Management

The Ethiopian Football Federation Premier and Bherawi League Management System has several objects that need persistent data storage and they are observed to have links between them to share attributes. This persistent data management deals with how the persistent data (file, database, etc) are stored and managed and it outlives a single execution of the system. Information related to player basic information, seat availability data, the match fixtures generated and other related information are persistent data and hence stored on a database management system. This storing data in a database enables the system to perform complex queries on a large data set.

This section describes how objects are mapped into tables and how the tables are related. In order to store information persistently we map objects into tables and the attributes into fields to the specific table based on the class diagram. Figure 4.4 shows some of the mapping of classes to tables.



*Figure 4.4 Mapping Classes to Tables*

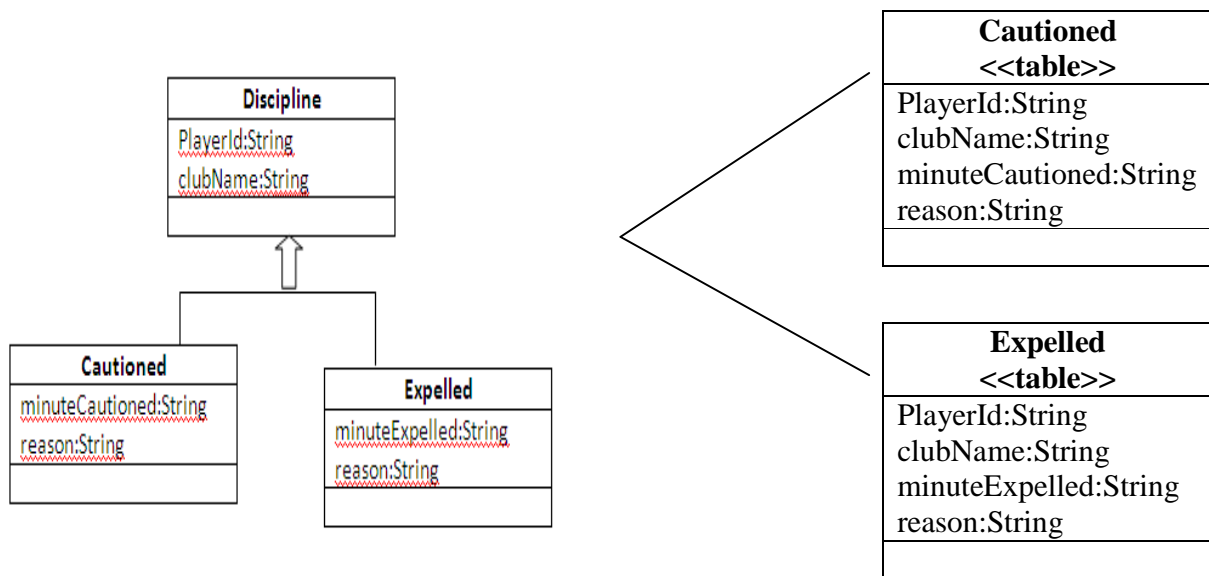
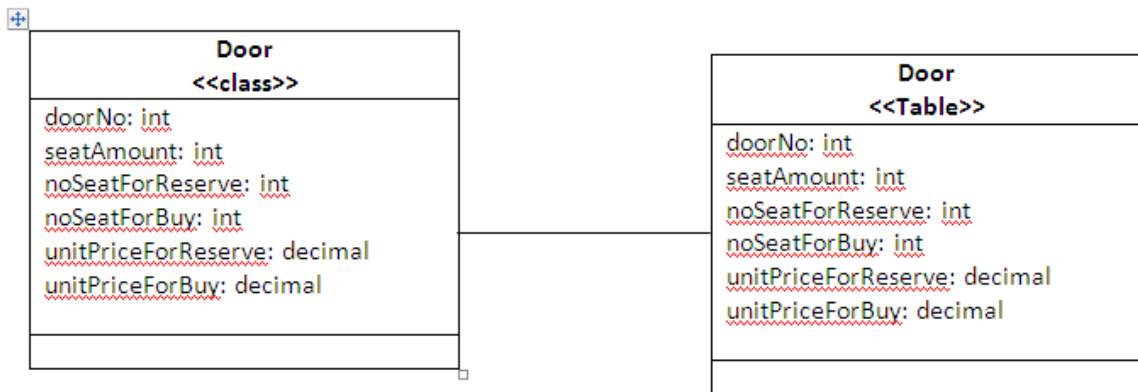


Figure 4.5 (Continued)

<b>Player</b> «table»
playerId: string «PK» playerName: string dateOfBirth: string placeOfBirth: string age: int position: string clubName: string playerJerseyNo: int playerNationality: String playerGameStatus: String registrationDate: string competitionYr: long int

<b>Match</b> «table»
competitionYr: long int matchId: string«PK» matchDate: string matchTime: string matchDay: string matchResult: string matchVenue: string matchLeague: string

<b>ScoreDetail</b> «table»
matchId: string «FK» competitionYr: string playerId: string«FK» scoreMinute: int scoreKind: string

<b>Door</b> «Table»
doorNo: int«PK» seatAmount: int noSeatForReserve: int noSeatForBuy: int unitPriceForReserve: decimal unitPriceForBuy: decimal

<b>Customer</b> «Table»
custId: string«PK» custFName:string custLName:stringl

<b>ReserveTicket</b> «Table»
custId: string «FK» doorNo: string«FK» matchId: string «FK» reserveDate: string noOfSeatReserved: int reserveStatus: string BuyStatus: string expireStatus: string

*Figure 4.6 (Continued)*

## **Chapter Five: Implementation**

This Chapter presents the various tools used during the implementation of the system and the prototype of the system.

### ***5.1 Programming Tools***

The web-based application is a multi-tier application by its nature, where functionalities are divided into tiers. This nature of the application enables the task division easy and increases flexibility. The web based applications requirements of technology are categorized into two: client technology and the server technology. The client technology is referred as browser technology. The browser technology is left to the client which could be Internet explorer, Fire fox or any. The server technology requirements are basically seen from three technology corners: web server, web pages and database. In this project we used Active Server Page (ASP.NET) for web forms, Internet Information Server as web server and SQL server for database management system.

We chose ASP.NET as it provides an object oriented method for creating GUI and developing dynamic web sites [17, 18]. We used C# code in the web page editor, which is one of the object oriented development languages in .NET (Visual Studio) and it is arguably the cleanest, most efficient language for .NET in popular use today. The most commonly used web server: IIS is used as a web server of the system and it is good for developing dynamic websites. Microsoft SQL server 2005 is chosen because it can easily be integrated with Microsoft visual studio 2005 that facilitates the database connectivity [19]. Moreover, this server has a feature of integration with Internet [20].

### ***5.2 The Prototype (EFF-PBLMS)***

#### **5.2.1 Screen Shots**



Figure 5.1 Screen Shot of Home Page Form

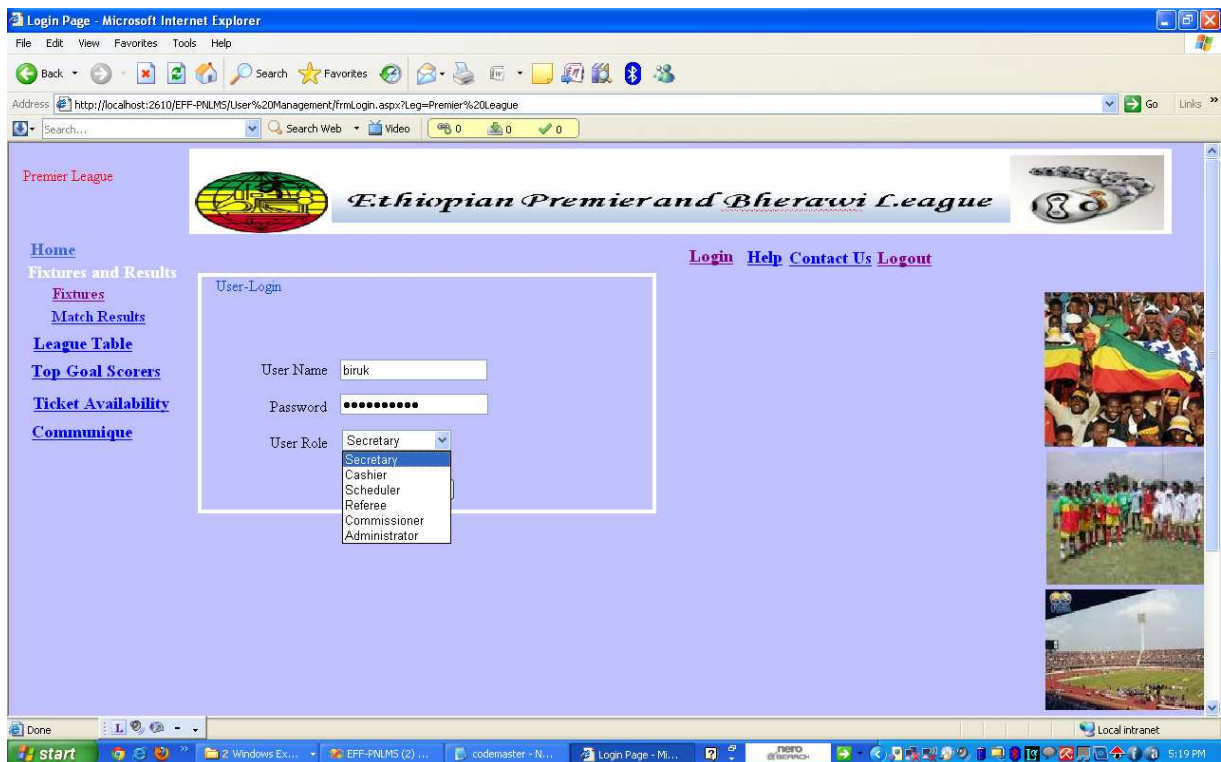


Figure 5.2 Screen Shot of Login Form

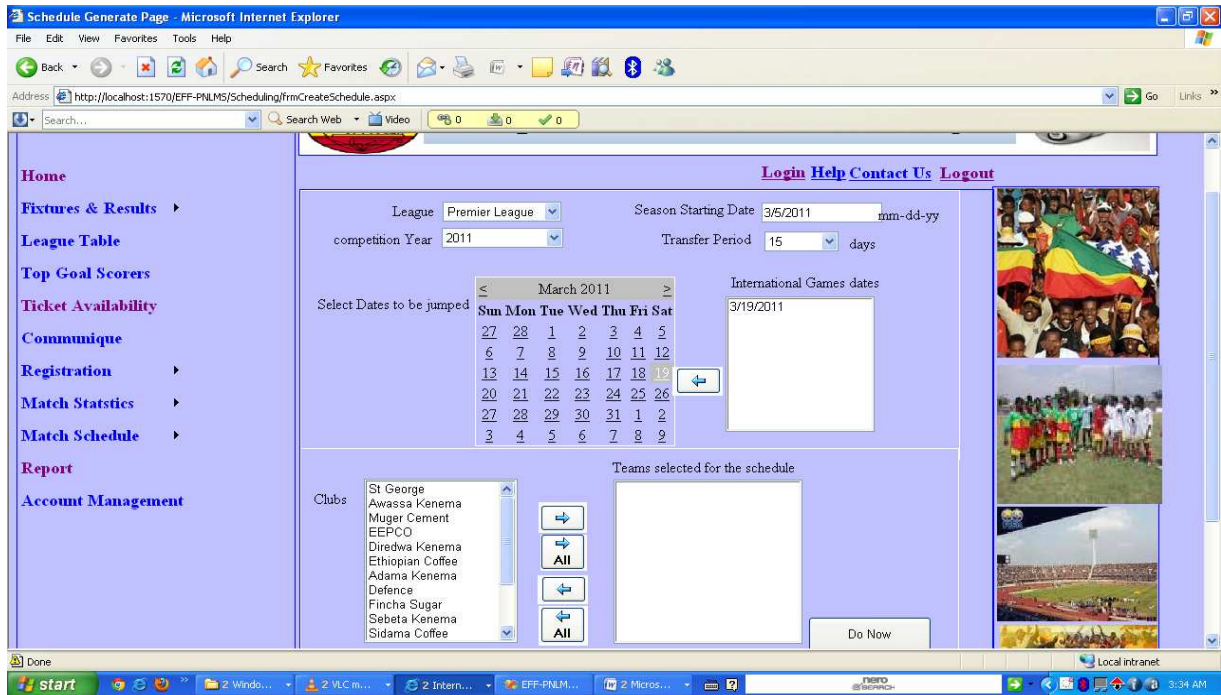


Figure 5.3 Screen Shot of Match Schedule Form



Figure 5.4 Screen Shot of Fixture Form

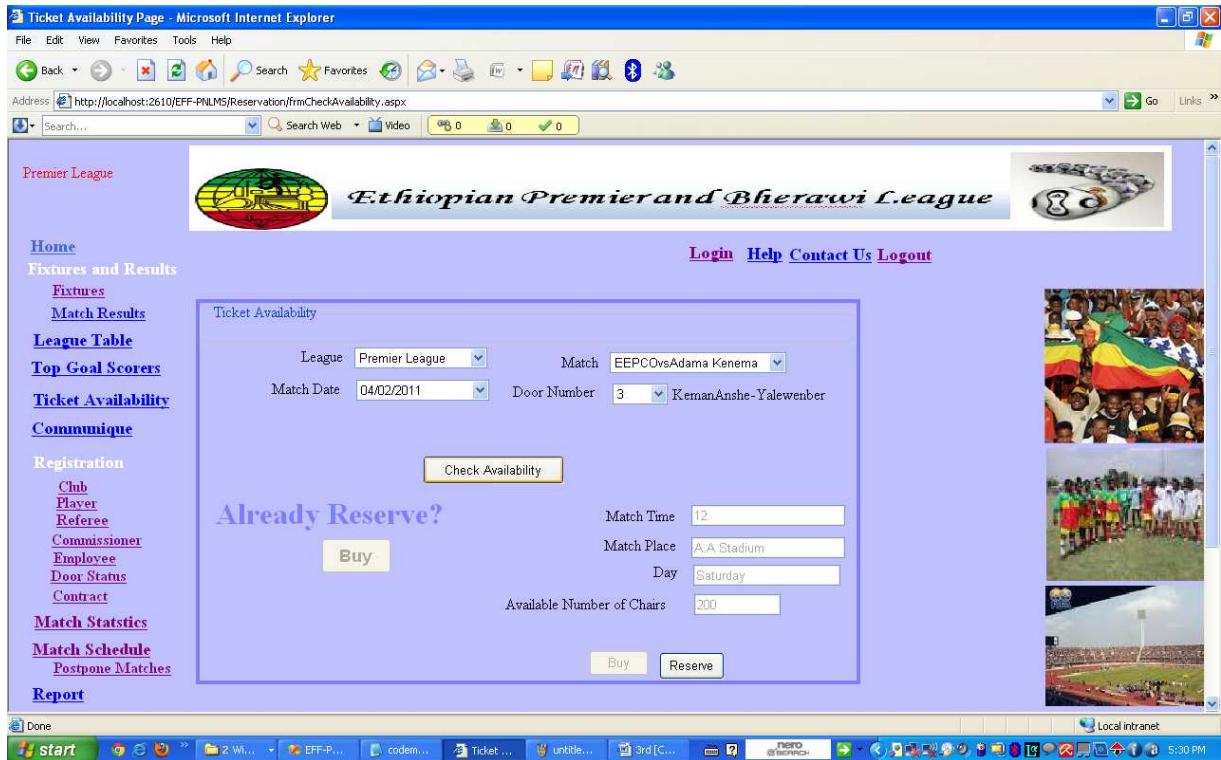


Figure 5.5 Screen Shot of Ticket Availability Form

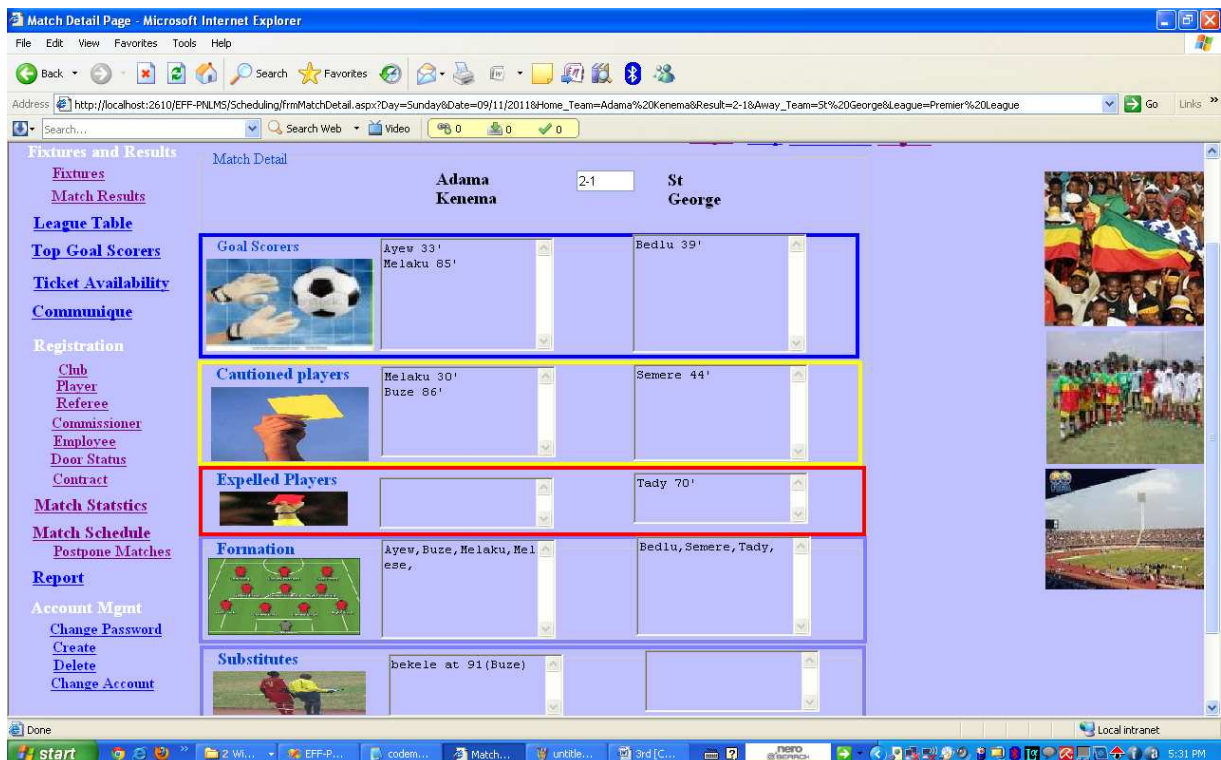
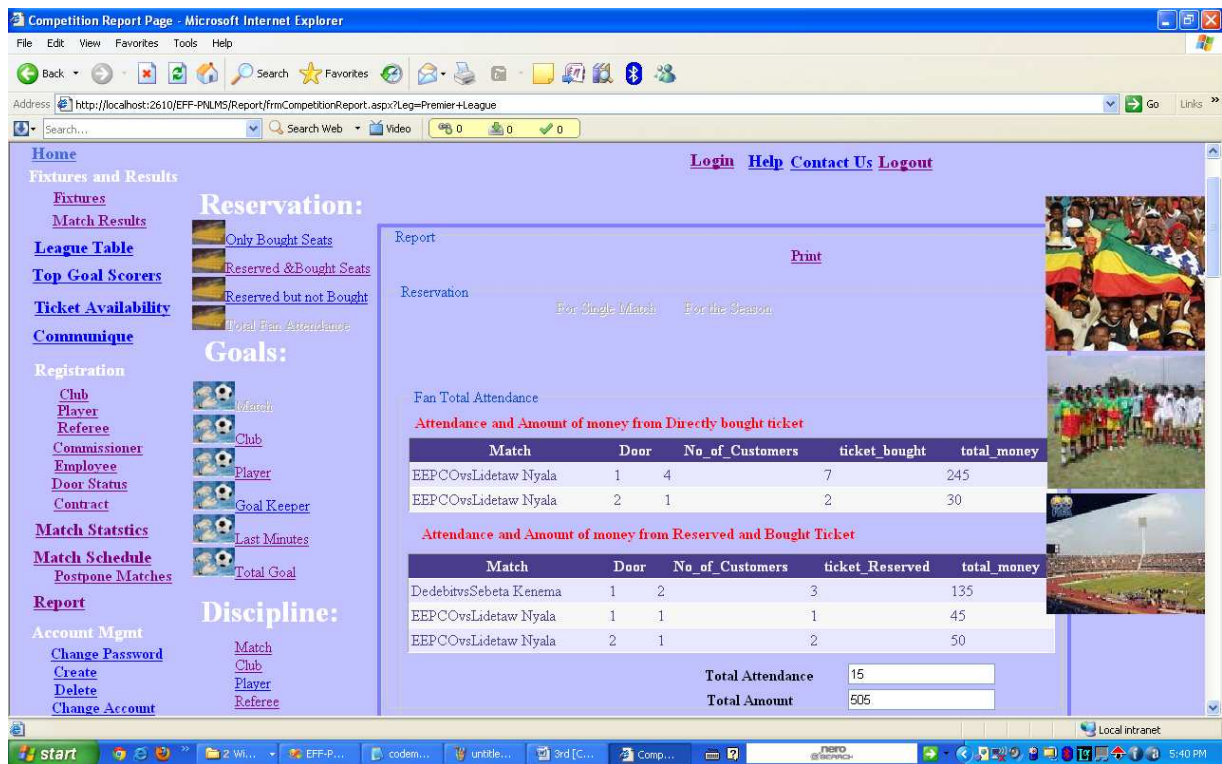


Figure 5.6 Screen Shot of Match Detail Form



**Figure 5.7** Screen Shot of Competition Report Form

## **Chapter Six: Evaluation**

To objectively evaluate the performance of the developed prototype, an evaluation was performed on the system. To this end, the evaluation was more focused on checking the robustness of the system on using the real information provided by the Ethiopian Football Federation. This Chapter presents the evaluation procedures followed and the experimental results obtained along with their explanations.

The evaluation of the system was performed in a two steps procedure. The first step in the evaluation procedure was the development of the test set. The test set is a set of criteria that has to be checked by the system. To test the robustness of the system, this test set is prepared with real data from the federation. The second step of the evaluation process was to experiment with the test sets.

### ***6.1 Development of the test set***

For the evaluation of the prototype, a test set of 112 real data samples from the federation is taken. In order to prepare the test set, we studied the most common problems that have occurred in the existing scheduling and seat management process. Then, we have found that the followings are the usual problems that have to be checked by the new system:

- Home-away distribution of the teams
- Day-off between consecutive games of the teams
- Postpone schedule process
- Transfer Player process
- Referee assignment process
- Seat reservation process

### ***6.2 Results and Discussion***

The experiment was conducted by feeding real data of the 2010/2011 from the federation. The output of the system was recorded for comparison with the expected results.

**Table 6.1 Experimental Results in Number of Test Sets**

<b>Test set</b>	<b>Number of Samples</b>	<b>Successful results</b>	<b>Clashes/disagreement with the expected</b>
Day-off between consecutive games of the teams	16 teams	14	2
Home-Away distribution of the teams in the fixture	16 teams	13	3
Postpone schedule process	20 fixtures	20	-
Transfer player process	20 players	20	-
Referee assignment process	20 referees	20	-
Seat reservation process	20 customers	20	-
<b>Total</b>	112	107	5

Out of the 112 test cases, the system was in agreement with the expected output on 107 test cases. However, on 5 out of the 112 test cases the system made wrong results.

**Table 6.2 Experimental results in percentage**

<b>Test set</b>	<b>Percentage of Successful results (%)</b>	<b>Percentage of Loss/clashes (%)</b>
Day-off between consecutive games of the teams	87.5	12.5
Home-Away distribution of the teams in the fixture	81.25	18.75
Postpone schedule process	100	-
Transfer player process	100	-
Referee assignment process	100	-
Seat reservation process	100	-
<b>Total</b>	94.79	5.21

As could be clearly seen from Table 6.2, the prototype was able to be in agreement with the expected result on almost 95% of test sets. The reason for the relatively higher agreement was because the schedule was made in consideration of most of the requirements of the federation. The system also poorly performed by 5% which could be attributed to one stadium being used by many clubs. In Ethiopia unlike other countries clubs, the number of clubs having the same stadium is so many. For instance: there were 7 A.A city clubs in the premier league this year. This will affect the schedule since there will be a possibility of matches in the same day in the single stadium. As a result home-away distribution and day-off b/n matches will be a little bit affected. However, in this project we tried to prepare another alternative (Postpone match case) for those unexpected matches in the fixture. Therefore the overall fixture will not be affected.

## **Chapter Seven: Conclusion and Recommendations**

### **7.1 Conclusion**

**Sports** like football have become a big business, with massive investments in players and structures. Professional and amateur leagues face challenging management problems involving logistics, revenue maximization, schedule fairness issues and game attractiveness, among other aspects. Particularly, scheduling the games of a tournament is certainly the most difficult area of league management. It consists of determining the date and the venue in which each game will be played and also includes assigning referees to games.

Many countries have been using the scheduling and reservation system for their national soccer leagues. However, because of some specific constraints that characterize each of these competitions, the systems and the models used in those countries are not readily applicable to soccer league scheduling problems in Ethiopia. In this project work we have analyzed the existing manual league management system being utilized by the Ethiopian Football Federation. Based on the information gathered we have designed and implemented a web based application that satisfies the constraints specified by the Federation. The prototype was also evaluated with real data from the federation and its performance was found to be very good.

### **7.2 Recommendation**

Even if the system facilitates scheduling, reservation and other management tasks of the federation, it doesn't consider the distance between home cities of each club in scheduling the fixtures. Since the travel cost of fans and clubs is one of the issues to be taken into account in scheduling, there should be a way in the system to capture and handle the issues mentioned.

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## **Annex**

### **Interview questions**

The following were interview questions that were prepared to raise discussion with personnel of the Ethiopian Football Federation and some fans for the purpose of identifying requirements and to analyze the system.

1. How many types of competitions are found in the federation?
2. How many clubs are allowed to participate in both Premier and Bherawi league?
3. What are the teams in the premiership in this year?
4. Who are the workers that are directly related to the premier and Bherawi league management and what are their roles?
5. How does the competition Organization committee prepare the season schedule?
6. How international games affect the schedule and how do they take measure for that?
7. How do they calculate the league table, top goal scorers and other similar issues?
8. How do they store data and use of it?
9. How referees are assigned for each game?
10. How do the customers/fans know the fixture?
11. How do referees fill the match statistics?
12. How does discipline cases handled?
13. How do financial penalties imposed to clubs and players are taken care off?
14. How do players' contracts accomplished?
15. How do the transfer zone is handled in the league?
16. How does the report of the competition prepared?
17. What are the challenges that have been happening in the existing system?
18. Is there any ways of seat reservation in A.A Stadium?
19. How do tickets and the amount of money from the matches controlled?
20. How many classes of seats are found in A.A Stadium and what costs are they and how many seats are found in each class?
21. What are the challenges that the fans faced?
22. What additional new features do you wish from the new system?

## Declaration

I, the undersigned, declare that this project is my original work and has not been presented for degree in any other university, and that all sources of materials used for the project have been acknowledged.

**Declared by:**

Name: Biruk Mulatu Wachiso

Signature: \_\_\_\_\_

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Place and date of submission: Addis Ababa University, June 2011.