



## **Sports Betting - Tipster Platform**

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# Abstract

Online Betting Tipsters platforms are websites where people provide betting advices, mostly with a betting analysis, in order to help other bettors to improve their results and grow their betting bank. Given the increase of online gambling all over the world (number of users and betting amount), these platforms demand have also been raising due to the need of getting relevant information about daily matches. This project enables any user to be a Tipster and to follow any Tipster to copy their tips, by placing real bets on a Sportsbook automatically. Our system will also allow Tipsters to use a Staking Plan, in order to help them and their followers to manage their bets and their Bankroll in a most profitable and secure way with the valuable help from Amazon AWS services. Additionally, our system provides unique features with the creation of two subsystems, that makes possible to hedge real bets and to select a future match (with unset odds) to be bet instantly once they are set.

## Keywords

Online Betting; Tipsters; Tips; Staking Plan; Amazon AWS



# Resumo

Com o aumento anual acentuado do número de apostadores e do volume envolvido nas Apostas Online, a necessidade e a procura de aplicações ou plataformas de apoio tem também vindo a expandir-se. Uma das plataformas (externas às Casas de Apostas) mais requisitadas são as de Tipsters — onde outros apostadores divulgam Tips (dicas de apostas) sobre todo o tipo de desporto, de forma a obterem um prémio mensal (pago por essas plataformas externas) caso se encontrem entre os melhores. Embora sejam bastantes úteis, pecam pela **falta de automatização** — caso seja desejado copiar as apostas de um certo Tipster, é necessário realizar tudo de forma manual — processo lento e de difícil concretização. Pelo que, o nosso Sistema apresenta um conjunto de soluções para solucionar estas falhas: em primeiro lugar, **permite seguir Tipsters**, sendo feitas **apostas automáticas** na Pinnacle Sports assim que esse Tipster submete uma Tip — Essa aposta é feita de acordo com o **Secure Staking Plan** ou com opção definida pelo Utilizador; Para além desta funcionalidade, foi criada uma **Betting Interface** que possibilita que um Utilizador faça apostas individuais directamente na Pinnacle Sports através da nossa página com a ajuda de algumas ferramentas; Por fim, qualquer utilizador pode submeter uma **Future Bet** (ainda antes de existirem Odds para esse jogo) que será realizada assim que existirem Odds (se a Odd for mais alta do que a submetida). Todo o processo de desenvolvimento é descrito ao longo deste projecto, principalmente na secção *Solution*, juntamente com a análise e resultados dos Testes de Usabilidade realizados com utilizadores na secção *System's Evaluation* que confirmam a sua Usabilidade, validando os objectivos a que nos propusemos.

## Palavras Chave

Tipsters; Tips; Apostas automáticas; Staking Plan; Betting Interface; Future Bet; Testes de Usabilidade





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# Acronyms

**IP** Internet Protocol

**FK** Foreign Key

**PK** Primary Key

**UC** Use Case

**AWS** Amazon Web Services

**API** Application Programming Interface

**UML** Unified Modeling Language

**CORS** Cross-Origin Resource Sharing

**HMAC** Hash-based Message Authentication Code





# 1

## Introduction

### Contents

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This document has the main objective to propose and present the **creation of a website, integrated with an automated software system**, which will make possible to everyone to get involved with Online Betting. Below, on next section, we are going to present the motivation which led to the development idea of this system. We are also going to show and explain its main goals and why it can be so important and useful for any User.

## 1.1 Motivation

Online Sports Betting or Online Gambling (if we also consider Online Casinos, Poker, Bingo and Lotteries) had its first important expansion around 1997 [1]. — also because of the rise of Internet users which is around 40.4% of World's population [2]. Online Gambling works the same way as on physical world casinos or bingos — with the exception that this is online and every betting platform accepts a huge variety of deposit and withdrawal methods, such as Bank Wire transfer, Visa, Western Union or many Online Wallets (Paypal, Skrill and Neteller, for example).

Table 1.1 illustrates the growth that is happening through Online Sports Betting [3]. We can observe that, on most countries, estimated market value has just increased, even on countries such as Germany, where betting is illegal, through Betting Brokers that allows people to bet on some bookmakers, charging them a percentage of their deposits and withdrawals.

**Table 1.1:** Estimation of market value (in millions) on Online Sports Betting

<b>Country</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>
<b>Portugal</b>	54.2	61.2	76.8
<b>Spain</b>	428.8	439.4	503.9
<b>France</b>	1060.7	1135.1	1194.6
<b>UK</b>	2151.0	2229.9	2258.7
<b>Germany</b>	790.5	570.5	600.9
<b>USA</b>	2302.6	2178.1	2125.1
<b>Canada</b>	1118.1	1154.9	1207.6
<b>Hong Kong</b>	1137.9	1255.2	1366.0
<b>Japan</b>	3267.9	3691.5	3809.4
<b>Australia</b>	1185.5	1276.2	1423.6

These high numbers are partially explained due to Bookmakers constantly offering bonuses (mainly Welcome Bonus, but also some bonuses to keep you as a frequent bettor), in order to try to acquire new clients every day. World-wide total amount of money involved on Betting is huge — this fact brings even more value to this project.

Focusing on Online Sports Betting, there are two different kind of platforms where it is possible to

place bets. The first, **Sportsbooks** (or Bookmakers), where you place bets, wait for outcome of a certain event and you earn (or lose) money from that bookmaker. Some well-known companies are, for example: Bet365, Pinnacle Sports, bwin, 5Dimes, SBOBet, 188Bet, Ladbrokes or TitanBet. Some of them also have a physical store, mainly in England, where any adult may place their bets.

Figure 1.1 [12] shows the process flow of placing a bet at a Sportsbook: a certain person places a £1 bet at 4.0 odds ( $Odds = \frac{1}{OutcomeProbability}$ ; If he loses, that bookmaker earns his £1, otherwise he earns £4 from them (£3 of profit).



Figure 1.1: Betting operation at Sportsbooks [12]

Secondly, **Betting Exchanges**, where you place bets against other people — you earn (or lose) money from someone else — it is a person-to-person betting. There are few companies of this type that guarantee revenue for a charge of at least 5% of each winning bet: Betfair, Betdaq and Matchbook, are some company examples — there are not many of this type — and Betfair holds the main importance due to the high amount being traded over the time.

Figure 1.2 [12] shows the process flow of placing a bet at any Betting Exchange: if a Player 1 believes Tottenham Spurs (imagine Spurs' odds are 1.50) is going to win and Player 2 the opposite — they are going to place a bet against each other, matching them at Betfair, for example. Player 1 risks 1€ to win 0.50€ and Player 2 risks 0.50€ to earn 1€ (risk amount of Player 1). And then Betfair takes a small percentage of the winning bet.



Figure 1.2: Betting operation at Exchanges [12]

Nobody cannot tell which type of betting platform is better — the main difference between these two

kind of platforms is that it is possible to do Trading on Betting Exchanges [25] — you can guarantee profit (no matter what outcome happens) only with the variation of odds on a certain event as we will approach ahead — even before that event begins — as it exactly happens on Financial Markets.

In particular, there are several factors that may distinguishes each Bookmaker [6]. First, its **Reability** (related with Trustability) with clients — some bookmakers show some payment problems or void winning bets without any reason. Second, the variety of **Sports and different markets** they cover — some offer few markets for each match of each sport. Third, the **odds offer** — some Sportsbooks offer higher odds for the same event. Fourth, **deposit and withdrawal methods** available — there is a numerous range of methods, however some Bookmakers offer more than other. Fifth, its **Customer service** — some Bookmakers have a live chat 24/7 or a fast e-mail time response. Sixth, **total limit** able to bet on each event — some only allows each player to bet around 100€ on a certain outcome. Seventh, the existence **Welcome bonus** — some Sportsbooks offer higher welcome bonus.

Some factors are more important than others (that relevance also varies from user to user) and, considering this situation, Pinnacle Sports is the one that has an excellent rating on almost every single point previously mentioned — this is the reason why (and because their API existence) Pinnacle is going to be used on the development of this project.

### 1.1.1 Tipsters Platforms Overview

There are some **external** platforms where Tipsters (Bettors who publishes tips — betting advice) can share their tips combined with a match analysis, for free or not — usually, in order to try to earn a monthly prize, paid by these external platforms from their profit on advertising Sportsbooks.

When a betting tip becomes too public, mainly because its analysis has a very relevant info (e.g any recent important news), becomes classified as **value bet**. Most likely, this event will have a lot of money bet on that single outcome (many times higher volume of money than any of the remaining outcomes), which will cause odd to fall, gradually and significantly — this is the way Bookmakers can guarantee profit no matter what outcome occurs [5].

Some of these platforms have a paid feature that allows any user to follow any Tipster registered at that website and receive their tips by mobile phone or e-mail, **however** the reception of those messages have always a big delay. Another issue is the fact that everyone — even if they follow someone — has to place every single bet **as fast as possible**, which is a cumbersome and time-consuming task.

## 1.2 Goals

Following the previous mentioned issues, the main goal of this project is to develop a platform (website) for users manage tips (e.g publish tips and follow other tipsters). Another key feature of this platform

is that it provides an automated module that places and copies bets from a Tipster.

In particular, the platform is intended to enable some key features as it follows. First, any registered user can publish tips, hence becoming a Tipster, and follow other Tipsters. Second, whenever an user publishes or shares a tip, each person who follows him and has a proper setting activated, the system will **automatically** have their betting accounts to place the exact same bet. This second point will make Bettors who use this system to **spare a lot of time** and **not to run the risk to see odds falling suddenly**, ensuring their profit is **maximized**. Third, even if someone does not know nothing about Online Sports Betting, they will still be able to invest their money by following some Top Tipsters on a ranking — sorted by ROI — Return on Investment, popularity and others. Fourth, similarly to placing a Tip, it will be possible Users to choose a bet to be placed automatically, even before the odds are available. This way Users may grab even better odds, taking advantage of being one of the first persons to bet on a certain outcome, as it will be approached on Chapter 4. Fifth, besides the Tips subsystem, we will also develop a Betting Interface that may help any bettor placing his bets through our page. In addition, we provide some tools to help them increase their profit or reducing their losses.

By developing this project, we will create something non-existent that will possibly bring great benefits for everyone who joins this platform, mainly through the implementation of automated betting and all developed tools.

## 1.3 Contributions

This dissertation contributes to the area of Betting Automation, however it also provides a great visualization of how Online Betting World really works, presenting its benefits and flaws, from basic concepts to advanced betting management strategies

In what concerns **Betting Automation** — the System's features are expected to bring the concept on automation on betting, by copying tips or using the Auto-Betting feature, which is unique; It will also improve users' betting experience, through the developed Betting Platform; Last but not least, it will make possible to non-bettors or inexperienced bettors to earn money on the Betting World, by using our exclusive and uncommon features.

## 1.4 Structure

The following chapters will present more specific information and knowledge about our project. Second chapter contains the background — every concept needed to understand the rest of the document will be approached there. Third chapter presents many different aspects from our Related Work — the beginning contains information and analysis about platforms similar to ours; Next, we will analyze some

Betting Strategies and then approach three different papers, relating them with our project at the same time. Fourth chapter contains everything about our System's Architecture and its Implementation, we are going to expound how it is designed and the decisions we had to do when some obstacles occurred. Fifth chapter presents our System's Evaluation performed by Usability Tests — We analyze them by showing Statistics related with their own information (e.g Age, Betting Knowledge) and with their performance while performing our tasks. On the last chapter, sixth, we display our conclusions along with the future work we are planning to implement.





# 2

## **Background**



In this section, important concepts related with Betting are going to be covered in order to understand how Sports Betting works. To begin we must understand what **Odds** mean — It reflects the probability of a certain outcome of a match that may belong to any existent sport. There are some ways to represent the Odds — the most commons are decimal (Europe) and fractional (United Kingdom). Fractional Odds are shown as  $\frac{3}{7}$  and decimal Odds are displayed by 1.25, for example. And we might use this formula to convert to the other format  $DecimalOdds = FractionalOdds + 1$ . Also, as Odds reflect the probability, it might be calculated by  $Odds = \frac{1}{Probability}$  Hence, if for a certain outcome the Odds are 2.00, it means it has 50% probability of happening.

There are a few websites, such as **Oddsportal and Betbrain** that offers to its registered users a list of betting Odds comparison — this is useful to search for value bets.

The Chelsea vs Liverpool match is sponsored by Netbet

31/10/15 12:45

Odds History Stats & Scores

1x2 Full Time Asian Handicap Over Under 1x2 with Handicap Anytime Goalscorer 61 markets

Operators	Home	Draw	Away	Payout
10Bet	2.10	3.40	3.70	96%
188bet	2.03	3.50	3.40	93%
18BET	2.07	3.23	3.62	94%
1Bet	2.10	3.15	3.65	94%
24hBet	2.05	3.43	3.60	95%
32Red Bet	2.08	3.50	3.65	96%
bet-at-home	2.02	3.36	3.60	93%
Bet3000	2.10	3.50	3.80	98%
bet365	2.05	3.40	3.60	94%
BETBRIGHT	2.00	3.38	3.60	93%
BetCRIS	1.99	3.55	3.90	96%
Betrally	2.10	3.45	3.75	97%
betsafe.com	2.10	3.40	3.70	96%
betsson	2.10	3.40	3.70	96%
Bitcasino	2.04	3.30	3.65	94%
ComeOn!	2.10	3.45	3.75	97%
Jetbull	2.04	3.43	3.60	94%
Ladbrokes.com	2.05	3.30	3.60	94%
Mybet	2.05	3.50	3.70	96%
NetBet	2.10	3.40	3.70	96%
NordicBet	2.15	3.40	3.70	97%

Figure 2.1: Betbrain Odds list from some Bookmakers for Chelsea vs Liverpool match

In Figure 2.1 we can observe a list of some Sportsbook and their available Odds for Chelsea vs Liverpool match for winning the match — there are three columns, where Home matches Chelsea's Odds, Draw column and Away to Liverpool's Odds.

- Highest Chelsea Odds: 2.15 at NordicBet — meaning around 46.51% probability.
- Highest Draw Odds: 3.50 at a couple of Sportsbooks — meaning around 28.57% probability.

www.Oddsportal.com (last visited on 12/10/2016) www.betbrain.com (last visited on 12/10/2016)

- Highest Liverpool Odds: 3.80 at Bet3000 — meaning around 26.32% probability.

*The sum of this three outcomes, usually, is less than 100% — this is the way Bookmakers guarantee their own profit every match — It is observable at Payout column.*

The probability for each of the outcomes on Figure 2.2 are 50% (Odds or Even outcome), the same of a coin toss [15]. Hence, fair Odds would be 2.00 for even and 2.00 for Odds number of corners, however they are not — Actually they are both 1.9, meaning each of them got 52.6% probability. This is the way Bookmakers take some more advantage when setting Odds and it happens for every single market available through every Sportsbook.

Total Corners Odd/Even	
Ímpar	1.90
Par	1.90

**Figure 2.2:** Betting market - Corners: Odds or Even for Benfica vs Atl. Madrid match

Their profit margin may be calculated by:  $Margin = 2 - 1.9 = 0.1$

$0.1/2_{possibleOutcomes} = 0.05 * 100 = 5\%$  profit margin for this specific market.

Each **Odds is generated by Bookmakers, through their algorithms** (which are nearly impossible to discover — if they were known, there would be many researches in order to find a way to beat them) and Betfair bettors will set (pre –game — before match starts) each market Odds according with those Odds on Sportsbooks. However, in–play — during match action — Bookmakers tend to adjust their Odds, comparing them with Betfair, because Odds on Exchange reflect in a fair way each Odds.

If we reckon that Liverpool's victory has around 35% of happening — it means Odds should be around  $Odds = 1/0.35 = 2.86$  — then there is **value to bet** on that outcome at any Odds higher than 2.86 — Hence, it is expectable we can achieve (positive) Expected Value by betting on Liverpool this match and following this strategy. There are some forecasting methods [4] that some people keep on studying claiming to find expected value on a long term [48]. These methods may work for a short period of time, however most of them are unlikely to be successful consistently, because time is running and Bookmakers already found ways to protect themselves against possible flaws they had some day before.

If one bets on a specific outcome, he is betting that outcome to happen and to **calculate profit or loss** of a bet done on a certain Sportsbook, we may use this formula:  $Profit = Stake * (DecimalOdds) - Stake$  If he risks 100€ at 3.80 Odds on Liverpool, it will bring him  $100 * 3.80 - 100 = 280€$  of profit (if that bet is settled as won). There are also Fractional Odds and they are displayed as 3/7, for instance — it means for each 7€ risked on a bet, it may generate 3€ of profit.

Following the previous example, as Odds will change during each match, according to what is happening on the match (e.g goals, red cards or remaining time), if we bet 100€ on Liverpool at 3.80 Odds before the match and then Liverpool scores a goal during the match, we may guarantee profit already — it is called **Bet Hedging** [26]. Imagining that it is now 0-1 and Liverpool Odds are 2.00 to win the match, there are manual ways to assure a part of the potential profit, reducing the risk from 100 to 0. Conversely, it is also possible to reduce the loss: Imagine at half time the current score is 0-0, Chelsea is dominating Liverpool and Away's Odds are 4.50. Again, manually, it is possible to calculate how much we need to bet on other outcomes to reduce our potential loss from 100 to around 20 whatever the outcome will be.

To conclude this section, we are also going to implement on this project a little tool to help bettors and Tipsters from this platform to manage their betting bank [14] better. This aspect will be analyzed on the next Chapter.



# 3

## Related Work

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## 3.1 Tipsters Platforms

Along this chapter we will show most of the existent Tipster Platforms, presenting their flaws and their positive aspects. It is possible to qualitatively separate some Tipster Platforms, according with the features they provide, as it follows.

**Low quality platforms** offer the a limited number of services, i.e Tipsters only can publish a Tip, competing to reach the Top Tipsters in order to receive a money prize. To follow their tips, it is required to visit their profile to check if there are new tips and it is very hard to follow every tip from a given Tipster. However, these platforms do not have an automatic alerting mechanism to notify users that a tip has been published. The following websites may fit this category, with the exactly mentioned features or some more, as listed:

- *ApostaGanha*, a portuguese website.
- *Academia das Apostas*, a portuguese website — managed by Paulo Rebelo (a portuguese millionaire betting trader) and aimed to trading learning, but it has also some Tipster competitions (only Football tips and most of them does not have any analysis). Another difference is that each user has to do a 1€ bet on a certain bookmaker to be able to win prizes — this is the only (indirect) cost.
- *Betshoot* — This one has a simplistic interface that helps users reaching tips they might want to check.
- *Bettingexpert* — It is possible to follow tipsters also.
- *Tipster Academy* could fit in last category — the big caveat is that each Tipster has to choose his main Sport and he can only share tips from that Sport. Another big difference is that there is no prize — they earn the chance to sign a contract to sell their tips on the website BetAdvisor — a platform of highest quality.

**Medium quality platforms** extend the low quality platforms — *BetAdvisor* is the one that fits this category and it is a mix between all the previous platforms. There are two Tipster categories — Junior or Senior — depending on how long he initiated his contract with the company. As it happens on Tipster Academy, each Tipster is only allowed to publish tips from a single sport. And each client must pay a fee (for 3, 6 or even 12 months) — which is different from Tipster to Tipster — in order to follow his tips. These tips are received instantly through e-mail. If a client wishes to receive them also via mobile

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[www.academiadasapostas.com](http://www.academiadasapostas.com) (last visited on 28/11/2015) [www.apostaganha.com](http://www.apostaganha.com) (last visited on 28/11/2015) [www.tipsteracademy.com](http://www.tipsteracademy.com) (last visited on 28/11/2015) [www.betadvisor.com](http://www.betadvisor.com) (last visited on 28/11/2015) [www.bettingexpert.com](http://www.bettingexpert.com) (last visited on 28/11/2015) [www.betshoot.com](http://www.betshoot.com) (last visited on 28/11/2015)

message, they have to pay an extra fee. Despite being an expensive service, it also does not have any automation in what concerns betting.

**Top quality platforms** extend the medium quality platforms, however they provide a wider range of features — On *Blogabet* is possible to follow a Tipster — but the only advantage on doing it, is that it makes possible to check every tip from every Tipster you follow on "My Tipsters" section — it works like a wall and each tip can be commented and discussed. It is also possible to pay an extra fee to receive notifications by e-mail from a maximum of 15 Tipsters you can select. The issue is that those notifications have a delay of around 3 or 4 hours, so when someone receives the notification, probably the Odds has already changed a lot and lost its value. Besides, there are Premium Tipsters and they charge a fee to be followed, making this service even more expensive.

**Best platform** (not related with Sports Betting) is the best type to exemplify even better what is the real point of this project, there is *eToro* (it is related with Financial Markets, not with Sports Betting, but it is a good analogy between these two areas). This software, *eToro*, is a kind of Social Network with the main goal to invest, negotiate, learn and share knowledge. Besides being possible to follow investors, there is also a wall to discuss ideas related with Financial Markets along with every registered user. Despite having a lot of features, the main one is the fact that any user can automatically copy every action that investors they are following do.

To summarize the previous platforms features, we designed a table presented Figure 3.1 that shows which platform has which feature, where we can see *eToro* highlighting himself as the best platform feature-related. We can see that *Blogabet* is the best Sports Betting Tipsters Platform, according to their System's features, however they do not present the Automated Betting feature.

	BLOGABET	APOSTA GANHA	BETSHOOT	TIPSTER ACADEMY	BETADVISOR	BETTING EXPERT	ACADEMIA DAS APOSTAS	ETORO ***
FOLLOW TIPSTERS	YES	NO	NO	NO	YES	YES	YES	YES
ANALYSIS	YES	YES	YES	YES	YES	YES	DEPENDS	YES
BETTING FEED	YES	YES **	YES **	YES **	YES **	YES **	YES **	YES
E-MAIL NOTIFICATIONS	YES *	NO	NO	NO	YES *	NO	NO	YES
SMS NOTIFICATIONS	YES *	NO	NO	NO	YES	NO	NO	YES
NO DELAY ON NOTIFICATIONS	NO	---	---	---	YES	---	---	YES
PRIZES FOR TIPSTERS	YES	YES	YES	YES	YES	YES	YES	NO
USERS COST	DEPENDS	NO	NO	NO	YES	NO	NO	NO
AUTOMATED BETTING	NO	NO	NO	NO	NO	YES	NO	YES ***

**Figure 3.1:** Table with existent platforms and its features

[www.blogabet.com](http://www.blogabet.com) (last visited on 28/11/2015) [www.etoro.com](http://www.etoro.com) (last visited on 28/11/2015)

\* - Requires additional payment.

\*\* - It is only a spot with the last tips inside each Sport, it is not like Facebook, where you can share something and everyone are able to comment it.

\*\*\* - Yes, but that platform has nothing to do with Sports Betting, only with Financial Markets.

## 3.2 Staking plans

Staking plan is one of the most important factors that bettors should care. It is the most-related concept with money management on Sports Betting and there are a huge variety of strategies [16], with new ones constantly emerging. We are going to look into some of them (the most famous ones), in order to understand which one may suit for overall bettors.

On all the following methods most people do not adapt their strategies according to Odds (Odds different than 2.00) — they keep following the same formula for each round as if Odds were always exactly 2.00. Given this situation, we created new formulas to adapt these methods to any selected Odds, showing when those methods may or may not work, in order to be able to compare them to choose the best one.

### 3.2.1 Martingale

Martingale is a recursive system that consists on betting an higher amount of money (depending on chosen Odds), after each losing a bet [17], trying to recover previous losses and guarantee profit when winning a bet. After winning a bet, bettor would start again this cycle. This method's cycle may be infinite if there's only losses, but would be 100% accurate if a certain player has an infinite bankroll and if there is no betting limit imposed by Bookmakers. This method is very common on Casino Roulette to play on Red or Black, Even or Odds and 1-18 or 19-36. However this formula may be used in order to bet on any Odds (not only nearly 2.00) and to define how much we expect to earn when winning a bet:

$$StakeRoundX = (TotalLossThisCycle) + \frac{ExpectedProfit}{(Odds - 1)}$$

If bet is lost:  $X = X + 1$

If bet is won:  $X = 1$

Table 3.1 shows an example of a bet flow applying this system: a certain bettor loses first four rounds and then on the round number five he recovers those losses and gets a profit of 50€. However, we can notice that is risked a cumulative stake of 1035.66€ to recover all losses only after 4 loss bets, which

may not be suitable to his Betting bank — this also happened due to a low Odds selected (1.50 on round three) that boosted the cumulative stake significantly.

**Table 3.1:** Martingale method example: 4 losses in a row

Round	1	2	3	4	5
<b>Cumulative Stake (€)</b>	50	75	425	583.3	1035.66
<b>Stake (€)</b>	50	25	350	158.3	452.36
<b>Decimal Odds</b>	2,00	5.00	1.50	4.00	2.40
<b>Result</b>	Loss	Loss	Loss	Loss	Win: 50€

The example on Table 3.2 used the same Odds as Table 3.1, however the flow of win/loss bets is different — on this one a certain player has the results: L-W-L-L-W (**L** means **Loss** and **W** means **Win**). This cycle has a cumulative stake much lower than the previous one, because of the winning bet on the second round.

**Table 3.2:** Martingale method example: L-W-L-L-W

Round	1	2	1	2	3
<b>Cumulative Stake (€)</b>	50	75	50	83.33	178.57
<b>Stake (€)</b>	50	25	50	33.33	95.24
<b>Decimal Odds</b>	2,00	5.00	1.50	4.00	2.40
<b>Result/Profit</b>	Loss	Win: 50€	Loss	Loss	Win: 50€

This method may be good for a short runs of losses, but could be awful, leading to betting bankrupt, if that run is a bit longer, also depending on used stakes — because most of Bookmakers have betting limits (depending on Sport, League and teams), which isn't higher than 4000€ (at most of them) — at smaller Sportsbooks, maximum bet allowed is not even higher than 100€.

### 3.2.2 Fibonacci

This loss recovery method is called by Fibonacci Sequence (0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233, 377, ...) and as Martingale, it may be infinite if there is not a winning bet [19]. It consists on following this bet stake sequence, after losing a bet, by betting the sum of the last two lost bets — whenever a bet is won, next bet stake should be the number corresponding two steps behind on the sequence.

As Martingale, this method is usually used on events with Odds around 2.00, however we are able to create our own Sequence, adjusting it with selected Odds with the following formula:

$$StakeRoundX = \frac{(StakeRoundX - 1) + (StakeRoundX - 2)}{Odds - 1}$$

If bet is lost:  $X = X + 1$

If bet is won:  $X = X - 2$

Table 3.3 shows a simulated sequence built by selected Odds and previous lost stakes - this sequence shows how much we should bet on seventh round after six consecutive lost bets. After win that bet on round seven, this bettor should go back two rounds with 206.78€ ( $287.2 * 1.72 - 287.2$ ) recovered from a total of 241.80€ (Cumulative Stake value on Round 6).

**Table 3.3:** Fibonacci method example: 6 losses in a row

Round	1	2	3	4	5	6	7
<b>Cumulative Stake (€)</b>	10	12.5	25	35	91.30	241.80	529
<b>Stake (€)</b>	10	2.5	12.5	10	56.30	150.50	287.20
<b>Decimal Odds</b>	2.10	5.00	2.00	2.50	1.40	1.44	1.72
<b>Result</b>	Loss	Loss	Loss	Loss	Loss	Loss	Win

If we compare it with the original Fibonacci Sequence, multiplied by 10 to match the first round stake of this example (10, 10, 20, 30, 50, 80, 130, 210, ...), we can notice that on this one: round seven cumulative stake (529€) is significantly bigger (than  $10 + 10 + 20 + 30 + 50 + 80 + 130 = 330€$ ) — due to lower Odds (below 2.00) chosen on round five and six. This fact can be confirmed if we compare round four cumulative stakes, where selected Odds were 2.00 or higher on our sequence, we observe that our sequence amount is smaller (35€) than Fibonacci's one ( $10 + 10 + 20 + 30 = 70€$ ).

Table 3.4 presents the same Odds used on Table 3.3 example, however the flow of win/loss bets is different — on this one a certain player has the results: L-L-W-L-L-L-W, with the final result of going back two levels (to level two again, after winning a bet on round four) with 10€ left to be recovered.

**Table 3.4:** Fibonacci method example: L-L-W-L-L-L-W

Round	1	2	3	1	2	3	4
<b>Cumulative Stake (€)</b>	10	12.5	25	10	35	114.55	259.76
<b>Stake (€)</b>	10	2.5	12.5	10	25	79.55	145.21
<b>Decimal Odds</b>	2.10	4.00	2.00	2.50	1.40	1.44	1.72
<b>Result</b>	Loss	Loss	Win	Loss	Loss	Loss	Win

Despite Fibonacci system being a loss recovery method, it shows that it is more capable to hold longer runs of consecutive losses than Martingale. However, both example shows that lost stakes on lower Odds are terrible, contributing a lot for the growth of **cumulative stake**.

### 3.2.3 D'Alembert

D'Alembert staking plan is based on the *Law of Equilibrium* — however it is also considered a loss-recovery system. This is a simplistic method that consists on levels [20].

We should start the cycle on Level (or round) 1 with a low percentage of bankroll stake and then: After losing a bet, we should advance a level and after winning a bet, we should go back one no matter the last betting result, the next bet is aimed to recover the last two stakes loss (sum of two previous level stakes) or to recover only one, if the player is at level 2 at that moment. This formula may be used to calculate the stake according to selected Odds:

$$Stake_{roundX} = \frac{Round1stake + RoundX-1stake}{Odds - 1}$$

If bet won:  $X = X - 1$

If bet loss:  $X = X + 1$

Table 3.5 shows a simulated sequence built by selected Odds and previous lost stakes — this sequence also shows how much we should bet on seventh round after six consecutive lost bets. After winning that bet on round seven, there are still 92.48€ to be recovered from this cycle. Comparing with Fibonacci Sequence, with the same selected Odds and first round stake, we can notice that *Cumulative Stake* is very similar on every round.

**Table 3.5:** D'Alembert method example: 6 losses in a row

Round	1	2	3	4	5	6	7
<b>Cumulative Stake (€)</b>	10	12.5	25	40	102.50	267.30	510.10
<b>Stake (€)</b>	10	2.5	12.5	15	62.50	164.80	242.80
<b>Decimal Odds</b>	2.10	4.00	2.00	2.50	1.40	1.44	1.72
<b>Result</b>	Loss	Loss	Loss	Loss	Loss	Loss	Win

Comparing Table 3.4 (Fibonacci Sequence) with Table 3.6 (D'Alembert), with the same selected Odds and same results each round, we can notice that Cumulative Stake on Fibonacci's method is a bit higher when a run of losses is longer.

**Table 3.6:** D'Alembert method example: L-L-W-L-L-L-W

Round	1	2	3	1	2	3	4
<b>Cumulative Stake (€)</b>	10	12.5	25	10	35	114.55	238.93
<b>Stake (€)</b>	10	2.5	12.5	10	25	79.55	124.38
<b>Decimal Odds</b>	2.10	4.00	2.00	2.50	1.40	1.44	1.72
<b>Result</b>	Loss	Loss	Win	Loss	Loss	Loss	Win

However, when there is a winning bet, that bettor will get a better reward for it, by going back two levels (**Fibonacci – One Step Forward, Two Steps Back [Vladimir Lenin]**), instead of only one step back (**D'Alembert**).

### 3.2.4 1326

Although 1326 is not very famous, it still may be good if used with the correct percentage. This method is divided in four levels: 1–3–2–6 — similarly to Fibonacci Sequence. To begin, a percentage (%) of your bankroll should be chosen to start this sequence — that percentage should be a maximum of 3% of your Bankroll, in order to risk a maximum of around 6% if you lose a bet on the second round.

After each win bet, you should progress to next level and bet a different stake, according to the formula. Whenever you lose a bet, no matter what level you are at, you should begin the sequence again from the start, on level one [23]. You also should start again the sequence whenever four bets are won in a row. As the previous staking plans, this one is also aimed at Odds 2.00, however we were able to calculate a new formula to adapt to different Odds:  $x$  – Stake correspondent to chosen percentage

Level 1 Stake =  $x$

Level 3 Stake =  $\frac{x*3}{Odds-1}$

Level 2 Stake =  $\frac{x*2}{Odds-1}$

Level 6 Stake =  $\frac{x*6}{Odds-1}$

Table 3.7 shows an example of 1326 Staking Plan being applied on a certain bettor with a starting betting bank of 200€, with some bet losses and wins.

**Table 3.7:** 1326 method example: L-L-W-L-W-W-W-L

Round	1	1	1	2	1	2	3	4	1
<b>Stake (€)</b>	2	1.98	1.96	5.88	1.92	5.79	3.9	12.36	2.19
<b>Decimal Odds</b>	2.10	4.00	2.00	2.50	1.40	1.44	3.72	2.02	2.00
<b>Result</b>	Loss	Loss	Win	Loss	Win	Win	Win	Win	Loss
<b>Betting Bank (€)</b>	198	196.02	197.98	192.1	192.78	195.33	205.94	218.54	216.35

By analyzing it, we notice that Stake on round number four (12.36€) is one of the most important there — if that bet is settled as lost, instead of win, that bettor's betting bank would go back to the point it was when the cycle started (or even worse if the mean of the first three rounds chosen Odds was lower than 2.00). Round four bet should be selected and analyzed even more carefully than any other, because if it is predicted correctly, bettor's betting bank will grow significantly as it is observable on the previous example.

### 3.2.5 Percentage

This method consists on always betting a percentage of your betting bank (that percentage should be a maximum of 10% - however the recommended by most people is 5% in order to better control your betting bank), recalculating the new bankroll after each win or loss. This philosophy is better to recover from losses, because a player does not risk a high percentage of his bank when trying to recover [21], but when you face a long run of winning bets, it will culminate on a slow progression on your betting bank.

If we choose to use 5% of betting bank, we might calculate our Stake by:  $Stake = Bettingbank * 0.05$

Table 3.8 shows an example of Percentage Staking Plan being applied on a certain bettor with a starting betting bank of 200€.

**Table 3.8:** Percentage method example: L-L-W-L-L-W-W

Round	1	2	3	4	5	6	7
<b>Stake (€)</b>	10	9.50	9.03	9.48	9.00	8.55	8.74
<b>Decimal Odds</b>	2.10	4.00	2.00	2.50	1.40	1.44	3.72
<b>Result</b>	Loss	Loss	Win	Loss	Loss	Win	Win
<b>Betting Bank (€)</b>	190	180.50	189.53	180.05	171.05	174.81	198.58

We can observe that after four bet losses and three wins, player's betting bank is almost unchanged (198.58€, less 0.7% than initial bankroll – 200€) and the highest stake risked was 10€, which is very good — that way, it will be hard for that bettor to lose all his betting money. This is one of the most balanced methods that relies on betting consistently in order to show some good results — it is hard to lose all betting money, but it is also tough to earn money quickly.



### 3.2.6 Secure

Secure staking plan is very similar to Percentage system, however the first one has in account which Odds you are betting, in order to adjust your stake with that fact — a bit of what we have been doing on the previous Staking plans when providing new formulas to Odds different than 2.00. To begin, a percentage of your Betting Bank should be chosen between 5% and 10% — 5% would make it even more secure and provide you better control over your Bankroll, because this method relies on betting a lower amount of money when the Odds are higher and an higher stake when the Odds are lower [22].

The following Table 3.9 presents a table with the parameters you should evaluate in order to calculate your betting stake:

**Table 3.9:** Secure method: Odds/Percentage

<b>Odds</b>	<2.1	<2.2	<2.3	<2.6	<3	<3.2	<3.5	<4	<4.5	<5.5	<7	<13	=>13
<b>% of Max. Stake</b>	100	90	85	80	75	70	65	60	55	50	45	40	30

This table should be read as 100% of maximum stake for Odds interval [1.01; 2.10[, 90% for [2.10; 2.20[, 85% for [2.20; 2.30[ and so on. If this method is correctly followed, adjusting your stake after each bet settlement, it would be very hard to reach the betting bankrupt, because it aims to reduce losses on loser bets and to increase profit on winning ones.

Table 3.10 shows an example of Secure staking plan being applied on random Odds with random results (five lost bets and only three wins) with a initial bankroll of 2000€ and using a maximum stake of 5%, being recalculated after each bet.

**Table 3.10:** Secure method example: L-W-W-L-L-W-L-L

<b>Round</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>
<b>Stake (€)</b>	100	57	103.27	86.33	41.44	101.52	62.25	100.64
<b>Decimal Odds</b>	2.00	3.90	1.90	2.50	7.10	1.44	3.72	2.02
<b>Percentage</b>	5%	3%	5%	4%	2%	5%	3%	5%
<b>Result</b>	Loss	Win	Win	Loss	Loss	Win	Loss	Loss
<b>Betting Bank (€)</b>	1900	2065.3	2158.24	2071.91	2030.47	2075.14	2012.89	2031.60

We can observe that despite having two more bets lost than won, that bettor would have 31.60€ of profit (2031.60-2000) after the eighth bet.

Also, the highest stake risked is only 103.27€ (on round three), which does not make a huge impact on his Betting bank even if it was a loss. Because of all these reasons, this system might be one of the best — it is very similar to *Percentage staking plan*, however it adjusts itself according to selected Odds,

making it more efficient.

### 3.2.7 Kelly's Criterion

Kelly's Criterion is way more complex than any other Staking strategy and very hard to be used by a beginner bettor – it consists on using a mathematical formula that evaluates the **value** of a certain bet [10]. The output of this formula corresponds to how much should be bet (a betting bank percentage) on that outcome according with how much value that bet has and with a bettor's bankroll. This strategy aims to maximizes both profit and loss – huge amounts of money can be earn or lose in a very short period of time. [7]

The formula to get how much % we should be on a certain outcome is given by:

$$AdvisedStake\% = ((Odds - 1) * (\%EstimatedOutcome)) - \frac{100 - \%EstimatedOutcome}{Odds - 1} * 100$$

Table 3.11 shows an example of Kelly's Criterion staking plan being applied on random Odds with random results (three lost bets and two wins) with a initial bankroll of 500€.

**Table 3.11:** Kelly's method example: W-W-L-L-L

Round	1	2	3	4	5
%/Stake (€)	20/100	2.06/12.36	16.7/101.96	10/50.86	23.64/108.2
Decimal Odds	2.00	1.85	2.5	3	2.10
Estimated %	60	55	50	40	60
Result	Win	Win	Loss	Loss	Loss
Betting Bank (€)	600	610.51	508.55	457.69	349.49

We can see that the percentage of stake is higher when betting value is also higher (as it happens on first and last round). The advised stake percentage, most of times is way higher than 5% advised on other staking plans, this could be good to grow your betting bank, taking advantage from value bets [24], but also could lead to a fast decrease of bankroll when losing some bets in a row.

### 3.2.8 Summary of Staking plans

After analyzing the previous existent betting staking plans and highlighting their strengths and weaknesses, it is possible to group them into two different categories:

1. **Loss chasing** – Worst option (e.g Martingale, Fibonacci and D'Alembert)

This strategy is related with Casino, but it could also be used through Sports Betting and it is the worst, because after each loss, the bettor should bet twice of the previous bet and it is relatively

easy to get into a run of consecutive losses [17]. This strategy may fit on a short run of losses for someone who holds a huge quantity of money, but on long runs of losses, it tends to lead to bettor's bankrupt. Also, Bookmaker's maximum bet allowed may dangerously interfere here in a bad way — not letting that bettor bet that higher amount [16].

## 2. **Bankroll maximizing and controlling** – Best option (e.g 1326, Kelly's Criterion, Percentage and Secure)

Although the remaining staking methods do not have all the same way of working, all of them aim for maximizing and better control the betting bank. 1326 and Kelly's Criterion main goal is to maximize the winnings (but also the losses) in short runs, however for long runs as analyzed before, even with their little bank protection, they are not the best.

Kelly's Criterion might be good to use in conjunction with another system, but using it alone is hard to be done and requires expertise — that is why it would not be beneficial to implement it to be used by overall Tipsters.

In overall, **Secure Betting staking plan** it is the best for long runs of bets [22] and the easier to use for most people. This tool should be implemented on my project, so that if a certain Tipster is willing to bet on Odds around 2.00, the system would automatically place that bet with 5% of confidence; if Odds are 14.00, bet's confidence should be  $5\% * 30\% = 1.5\%$  of the betting bank.

## 3.3 Scientific Research

### 3.3.1 Efficiency in Horse Races Betting Markets : The Role of Professional Tipsters

In this research [27] Deschamps & Gergaud analyze a huge data-set of around 11.000 predictions on Horse-Racing through 318 different races from 35 professional French Tipsters, published on the daily newspaper Paris-Turf.

A forecasting model was developed in order to test and detect exaggeration on the published tips — the model consists on assigning scores to each Tipster, according to how many horses they correctly picked to be in the Top 5 (or any other Top, according to how many horses were running), getting extra points when a Tipster predicts correctly the Horses place by arrival order.

This analysis was made with the assumption that every single Tipster has access to the same kind of information (public information about each Horse or Jockey's last results, for instance). It is also stated that on average these Tipsters accuracy is better than other persons' predictions. As there are

a significant number of Tipsters competing, some of them tend to pick some unexpected horses as winners, trying to differentiating them from the rest, getting a big advantage — this fact may also affect this analysis.

The work concludes that most Horse Racing Tipsters tend to make risky predictions, in order to highlight themselves among other Tipsters, exaggerating on their Tips more than expected. This event will make markets not being totally efficient, because bettors will follow these professional Tipsters, placing huge amount of money on their outcomes [28]. This will generate betting opportunities to the more conservative and cautious Tipsters (and bettors), because of these market's inefficiency. Horse Racing was the analyzed Sport, but this happens on every single Sport — Mainly secondary football league matches or Tennis matches where Odds vary often with tips release.

Regarding our project, this paper shows Tipsters influence and significance, which creates the necessity to organize Tipsters statistics the greatest possible, in order to show Users (who are willing to follow some Tipsters) all betting strategy information about them. Otherwise our Users may follow certain types of Tipsters that they did not really want to. Also, these type of Tipsters who abuse on exaggeration are not expected to make part of our platform, since we do not offer any prizes at the moment.

### **3.3.2 Testing semi-strong efficiency in a fixed Odds betting market**

In this paper [29], Bernardo, Ruberti & Verona try to measure the efficiency of semi-strong markets on Sports Betting. They classify as semi-strong those markets (or matches) where Odds correspond almost perfectly to each outcome probability (i.e each outcome Odds are fair and there is no value on any of them) and where they are adjusted immediately and efficiently to any important news. [31]

Hence, the markets they choose to analyze belong to the four major European Football championships (Italy, Spain, England and Germany). To do this, they choose to examine the following matches after a coach replacement on the middle of a season. From 2006 until 2013, they found 203 cases over these four leagues and their analysis lead to an increase on all these leagues with Spain having the highest percentage (87%) of better results after the change.

To test Markets' efficiency (i.e if Odds are fairly set), they will try to apply a betting pattern to get profit from Managers replacement — They tested this event by simply betting on the first four matches after the arrival of the new team manager. After summing all four leagues and all seven seasons, they reach the payoff of around 9%, which makes this potentially a good method to earn money on long term. Following the last paper [27], on these semi-strong markets (where everyone has access to the same information) is still possible to find inefficiency on Markets [30] and, consequently, apply a betting pattern as this one that would bring profit.

Regarding our project, this specific event (coach change in the middle of a season) is just one of a dozen and shows that a profitable Tipster (or bettor) do not need to have inside information to keep

making profit (finding Markets inefficiency). As this one, there are many unexplored perspectives that may be successful on Online Sports Betting.

### 3.3.3 Doubling Revisited: The Mathematical And Psychological Effect Of Betting Strategy

Along this research Turner & Horbay [32] examine and simulate tests using different types of betting strategies (i.e from increasing bets after winnings — similar to 1326 Staking Plan, increasing bets after losses — similar to Martingale or Fibonacci — and using constant bet size) regarding Casino tables and Slot Machines (where exists a negative expected return). Because of that Negative Expected return (there are no **value bets**), they state it is not worth to apply Kelly's Criterion since it relies on Value Betting.

Most gamblers state that doubling their bets after a loss (Martingale or other Loss-Chasing strategy [17]) improves their chances to profit. As we stated when analyzing Loss-Chasing systems, they also may lead to a fail in a spectacular manor and may also lead to gambling problems [33] (e.g Bankruptcy). Not only people who increase their stake after a loss, but also people who do it after a win may suffer gambling problems, because they tend to treat earned money as *Casino's money* (when someone treats earnings as money they are not afraid to lose by betting more and more).

Then, they simulate 1000 bets using each Strategy mentioned before for Roulette and for Slots, presenting graphs for each one with the evolution of profit (or loss) with number of bets made. There are few occasions (only two in a total of twenty) where a certain bettor would get profit after these 1000 bets on Casino — the remaining 18 simulations lead to losses. This would probably be slightly different on Sports Betting, because oppositely to Casino, it is possible to find positive Expected return, since we can find value bets often.

Regarding our project and our Staking Plans analysis made before, this paper strengthens our point of view about them — Loss-Chasing strategies are not suitable, especially for long runs of bets; Also, other Systems as 1326 [23] or D'Alembert may be less aggressive, however still not optimal. This way we may reinforce that **Secure Staking Plan** is the most appropriated strategy suitable for the **overall** users and for **long runs of bets**.



# 4

## Solution

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In this section, we will present our designed Architecture and Implementation, along with the decisions we had to make our system the most functional, usable and secure possible. To start, we will present the changes (and additions) on planned functional requirements, then we will show and explain every detail regarding our Architecture along with Implementation algorithms and used technologies.

## 4.1 Functional Requirements

Besides the necessity to guarantee Data Security on every User sensitive details and other non-functional requirements, our system most important requirements are listed on Table 1 located at Appendix A.

Following that list of requirements, we decided to design a Flowchart diagram (Figure 4.1) with the main objective of allowing each to understand and visualize how our System really works [34], depending on user's desired action and, at the same time, how it is logical split on three different Subsystems: Tips, Autobetting and Betting Interface.

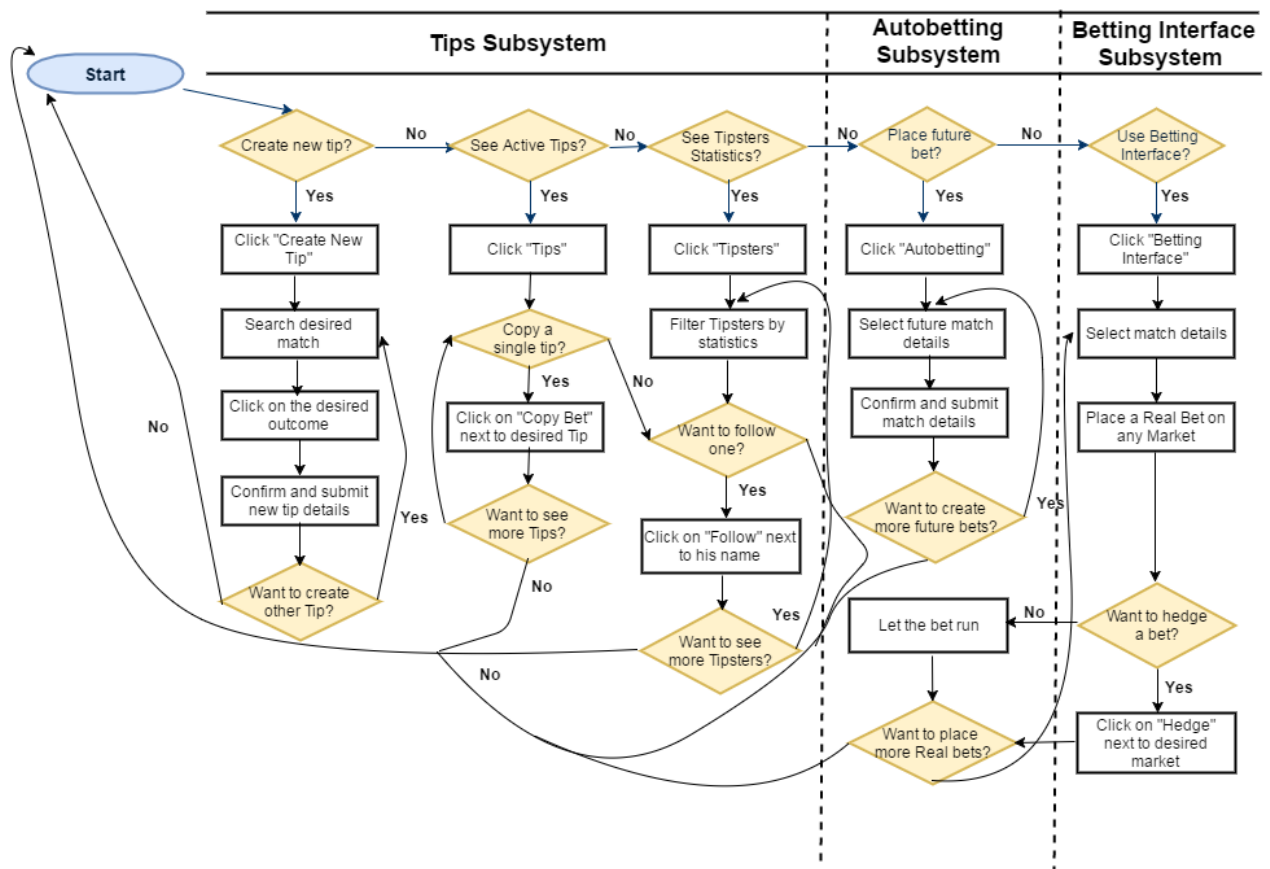


Figure 4.1: Flowchart Diagram

We can observe on Figure 4.1 our three Sub-Systems — that contains the features mentioned on Table 1 at Appendix A. These set of features were implemented the most simplistic way possible, being user-friendly, so that each user can perform any action with a couple of clicks. [35]

Flowchart Diagram exposes the main User Decisions over the colored diamonds, along with actions they should do to complete each task, since their beginning until they are completed. Also, some Use Cases (Figure 5.1) were made based on this diagram and will be linked to Test Cases on the following chapter.

## 4.2 Architecture and Implementation

As proposed before, the developed system uses the well-known Three-Tier Architecture [36] which is divided in three different parts:

1. **Client Tier/Front-End** - Corresponding to the part that contains everything (HTML Elements) a user can see and interact, accessible on any browser through any device connected to the Internet, known by Graphical User Interface (GUI).
2. **Web Server Tier/Application Server** - This part is fully developed with PHP, Javascript and JQuery. It is the bridge between Users and system requests to the Back-End (or even to its own) and its responses to the Front-End, exposing necessary data to GUI. Along with Back-End (and other described services), this is the Tier that will process every single feature.
3. **Database Tier/Back-End** - The last piece is where everything is stored and handled. It includes the Drupal's MySQL database, the Filesystem or the Cron Jobs Scheduler [39], for instance.

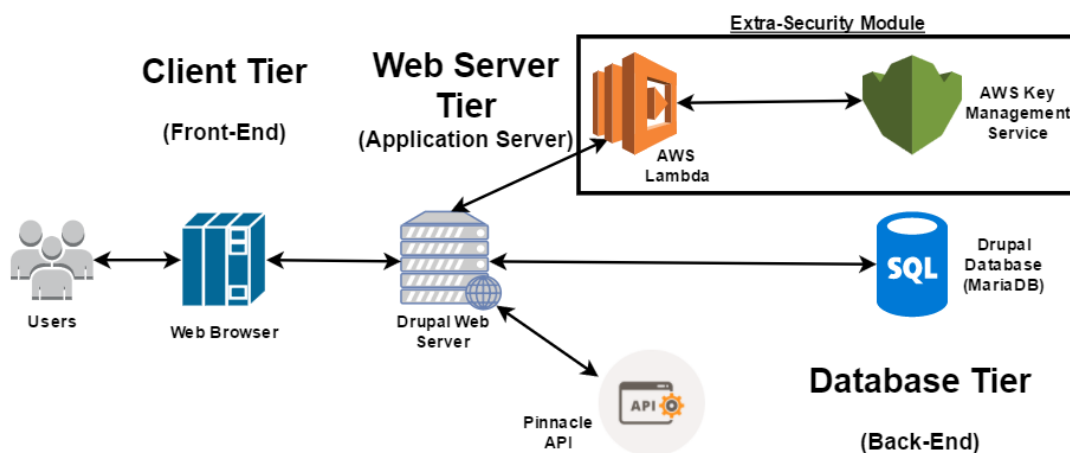


Figure 4.2: System's Architecture

Figure 4.2 shows the complete Architecture for our System, including the technologies and external services we decided to use and which part communicate with each-other. We can see our Web Server is using Drupal [37] (a CMS — Content Management System, similar to the Worldwide known Wordpress). Pinnacle API, Amazon AWS Lambda and Key Management Service [38] as external service to help placing bets and securing user's data, respectively. These external services will be approached in detail over the next sections. As mentioned, Drupal Web Server works as a bridge between himself, Database and Web Browser that exposes all visible information to the user.

### 4.2.1 Front-End

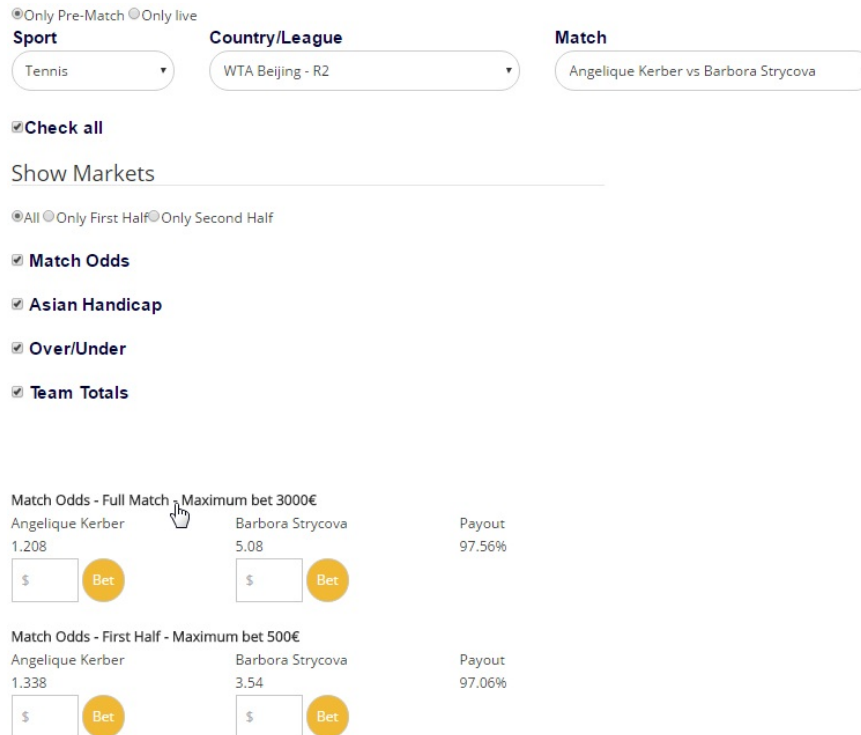
Regarding Client Tier, as the website uses Drupal, every developed page uses a theme (a template) that we choose to automatically renders each page using its own CSS rules.

We have not explored Drupal Front-End features too much, we preferred to create our own Elements and design them the way we like. Every page information is retrieved directly from its PHP file or from JQuery Ajax responses (after User interactions or automatic system scripts) and, depending on the type of information to be shown, we decided to use different Elements and different CSS Rules, constantly trying to make it the most simple and usable possible. [40]

The main issue we faced was getting to know Drupal — it is very hard to get started with and to understand how it works. We took days and days to found out how to do some little things, such as "including other PHP file" on the current one. Other issue was getting Betbrain's iFrame to work properly (getting User's clicks on it) — Since we needed it to get match events and odds. We are updating each page information dynamically by updating its body — by replacing it totally or adding some HTML content to it.

Figures B.3 and B.4 on Appendix B, figure 4.3 and 4.4 below demonstrates our different interfaces design. Figure 4.3 shows our Betting Interface subsystem page after choosing **Tennis** as Sport, **WTA Beijing - R2** as Country/League and **Angelique Kerber vs Barbora Strycova** as Match. Before that we have an exclusive radio button to choose whether we are looking for a match that did not start yet (Pre-Match) or a match that is happening right now (Only live). After choosing a match, the markets will load and render as shown below.

To make easier to hide or show a certain market of that match, we created a filter called "Show Markets" in Figure 4.3 — these options will cover all existent markets on Pinnacle and one of the three radio buttons can be used together one or more check boxes. For instance, if we only want to see the odds for the First Set Winner, we would pick "Only First Half" on radio button and then uncheck all boxes except the first one "Match Odds". It is also possible to minimize and maximize a certain market as it is observable on the Figure 4.3 — When cursor is over the market title.



**Figure 4.3:** Betting Interface page

## 4.2.2 Application Server

Following our System's Architecture in Figure 4.2, the Application Server may be divided in a couple of different parts. We opted to approach them by analyzing sequentially (following the order we performed its implementation into our System), in a minutely way, as it follows.

### 4.2.2.A Betbrain

Although Betbrain is not an element on our Architecture diagram, getting Betbrain's iFrame (to show all available Odds for all matches) to work was our first objective as we needed it to do everything else — We needed it to create a new tip. Betbrain's iFrame and the integration with PHP, Javascript and JQuery have a steep learning curve, hence we spent a long time figuring out how to use these important technologies in the implementation phase to make it work perfectly.

**Firstly**, we tried to print the iFrame code directly (`<iframe src="http://betbrain.com/football/?portalId=1351" [3] height="1090"width="670" frameborder="0"> </iframe>`) to recognize a user click on it, however it always generated Cross-Origin Resource Sharing (CORS) problem [41]. After trying few workarounds,

such as using third party frameworks, none was successful. **Hence**, instead of printing the iFrame, we tried to scrap each page and print its HTML code — all content — on our website. It worked, but with some bad formatted elements, some images missing and nearly zero buttons working. **In fact**, before printing the content, we managed to change all button clicks destination (because we noticed how their links work) to request a new page from Betbrain. When "Tennis" was clicked, the system would get the content of `http://betbrain.com/tennis/?portalId=1351`. And when a some odds field was clicked, a pop-up was shown with all correct information. However if odds were gathered from another page of Betbrain's iFrame (i.e getting from the specific match odds page, instead from Live Matches page), it would be a nightmare, because all DOM elements were differently positioned (or organized) or with different IDs.

The final solution encountered to fix this long and painful problem was to mix a little bit of these two last tries. **We begun** by getting `http://betbrain.com/?portalId=1351` HTML content and remove some elements (bad formatted ones and drop-down menus, for example), in order to reduce design's complexity and possible errors. **Afterwards**, we created different Javascript onClick functions to treat different clicks (redirect to another page or select an outcome for a match) and gather all different information, depending on which page the user is.

Also, in order to ease the usability of our platform in this matter we decided to apply two different cursors to two important different elements. In Figure 4.4 we can see that when mouse is over an outcome, cursor icon changes to a bag of dollars to show that a Tip may be chosen by clicking on that place; And whenever it is over a clickable link, it shows the hand pointer cursor, as it usually happens.

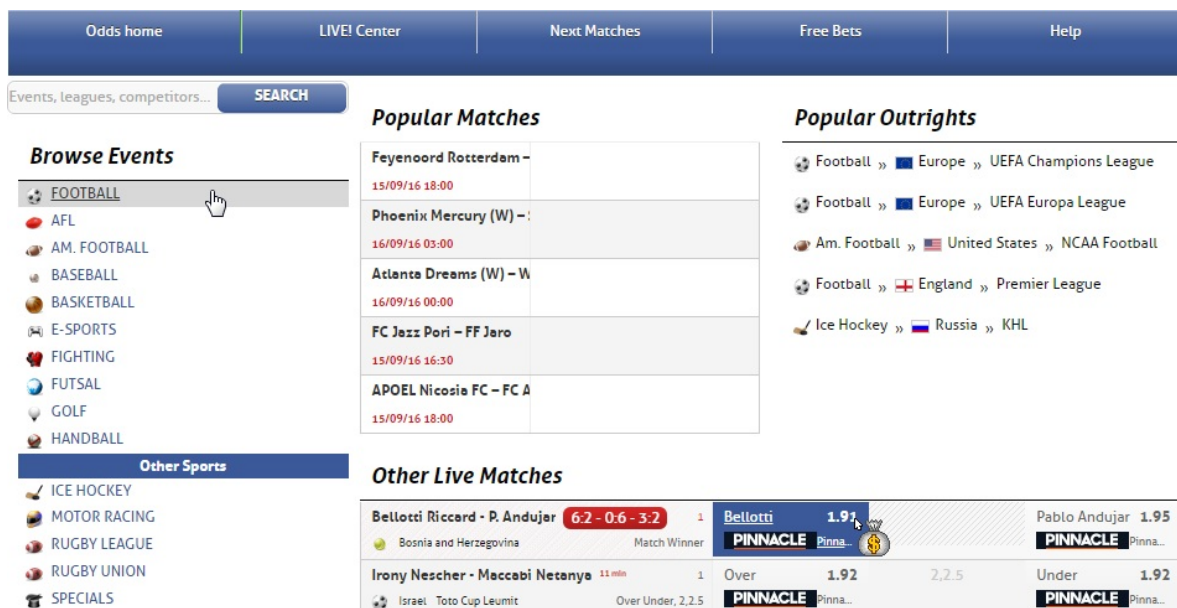


Figure 4.4: Create a New Tip page

Figure B.1 at Appendix B shows the original Betbrain homepage, which comparing with our iFrame design now (Figure 4.4) we can notice the removal of an high number of elements and how simpler it is now. One of the most important buttons that was generating an error was **Search** — We had to create a special Javascript function only to handle user searches, in order to make it work as expected, showing all search results inside the iFrame.

#### 4.2.2.B Pinnacle API

After Betbrain fully implemented (creating and posting Tips was now almost behaving as expected) we moved into Pinnacle API integration, by trying to place a single bet using PHP, since we need it to develop the script to place bets when following tips. Integrating Pinnacle API (RESTful service) had a steep learning curve, hence we spent a some time figuring out how to use these relevant technologies as the Application Programming Interface. After it, the API looked simple to use and almost every response could be retrieved as JSON or XML. On every API call, the user parameters (username and password) should be passed on header following the format *username:password* base64 encoded and along (after) with the string *Authorization: Basic* .

```
function apiCall($httpMethod, $endpoint, $credentials, $options) {
    // Criar URL para API
    $api_url = "https://api.pinnaclesports.com/v1/" . $endpoint;

    // POST ou GET, caso seja POST irá juntar os argumentos ao URL
    if($httpMethod !== 'post'){
        if(count($options) > 0) {
            $api_url .= "?" . http_build_query($options);
        }
    }
    // Iniciar CURL
    $httpChannel = curl_init();

    // Opções do canal CURL e fazer setup do Header a enviar
    curl_setopt($httpChannel, CURLOPT_URL, $api_url);
    curl_setopt($httpChannel, CURLOPT_RETURNTRANSFER, true);
    curl_setopt($httpChannel, CURLOPT_HTTPHEADER, $this->getHTTPHeader($credentials));
    curl_setopt($httpChannel, CURLOPT_SSL_VERIFYPEER, false);

    // POST
    if(strtolower($httpMethod) === "post") {
        curl_setopt($httpChannel, CURLOPT_POST, true);
        curl_setopt($httpChannel, CURLOPT_POSTFIELDS, $options);
    }
    // Get the response from Pinnacle API
    $response = curl_exec($httpChannel);
    curl_close($httpChannel);

    // Retorna JSON ou XML, dependendo do tipo de pedido
    return $response;
}
```

Figure 4.5: Pinnacle API call function

Figure 4.5 shows the main function we use to setup the request to Pinnacle API and to get the response. We can observe that the function only takes four arguments: **httpMethod** to distinguish GET from POST method; **endpoint** that is different depending on the kind of data we want to get; **credentials** that contains User's username and password, in order to create the HTTP Header; **options** which is used when the HTTP method is POST.

In what concerns automated betting, after we get all the match details, such as team names or sport, we are using the endpoints **sports** to match the sport, **leagues** to match the league, **fixtures** to find what is the **eventId** of the match between Team 1 and Team 2, **line** to find the correct market to bet and get its **lineId**; After getting all these IDs, we are using **bets/place** endpoint to finally place the bet automatically. We have also attached to Appendix B (Figure B.2) our PHP Code that handles the automated betting part — We can see the need to iterate over Sports, Leagues or Matches to gather the necessary IDs. The last part is the most non-trivial one that analyzes the type of market of a certain Tip to create the parameters (different from market to market) to finally place the real bet on Pinnacle Sports.

#### 4.2.2.C Security

Tips are being created and posted, bets are being placed automatically, therefore securing User's Data was now the main challenge in this project, as we must uphold all the system's security requirements. Drupal itself has a high number of features and modules that can be installed to increase its own security — at this time we did not install any, we have only the default settings here.

The most important aspect of this project is to secure each User's Pinnacle Username and Password — The hardest matter to deal with is the need to be a **Two-Way** encryption — because we need to encrypt and decrypt data automatically — instead of only One-Way (this type of encryption do not require to decrypt data — e.g confirming if password is correct on login — it is possible to encrypt the input password and compare it with the encrypted password stored on the Database to check if it matches) which makes it non-trivial to develop [44].

After analyzing the potential threats on this type of encryption and possible improvements, we found out that three different unfavorable behaviors may occur. Hackers can access the **Database, Filesystem** (Source Code) or **inject scripts** on the website [43]. Eventually, if a hacker gains access to this three different sources, he would be able to discover any Username and Password from Pinnacle, because they would know the complete Encryption Algorithm we designed.

We edited an Encryption file [42] that uses *key stretching* (simply by applying a function that uses the standard PBKDF2 derivation, to make the data longer and stronger), hides the *Initialization Vector* in order to create scrambled up keys every time and does *HMAC verification* of source data (because HMAC output is an hash of the concatenation between the generated key and the data to encrypt).

Perfect solution would be composed by three different keys: **Server Key**, **User Key** and **User Private Key**, where the first two would be stored somewhere in-between database and/or file system, and the **User Private Key** would be an input by each user to retrieve the sensitive data (in this case, his own Pinnacle Username and Password).

**However**, as the system must decrypt it **automatically** without user's permission, this third key should be retrieved (automatically) in a different way — The solution was to have something about encryption outside Drupal that could be accessed **only** from Drupal when we needed to retrieve them to place the bets automatically, for instance.

Then, we found out **AWS Amazon Services** [38], a secure cloud services platform as described below:

*"Amazon Web Services (AWS) is a secure cloud services platform, offering compute power, database storage, content delivery and other functionality to help businesses scale and grow. (...) to build sophisticated applications with increased **flexibility, scalability and reliability.**"*

From their big range of services, and after an intensive research on their numerous alternatives we figured out that a service called **Lambda** was able to run single pieces of code:

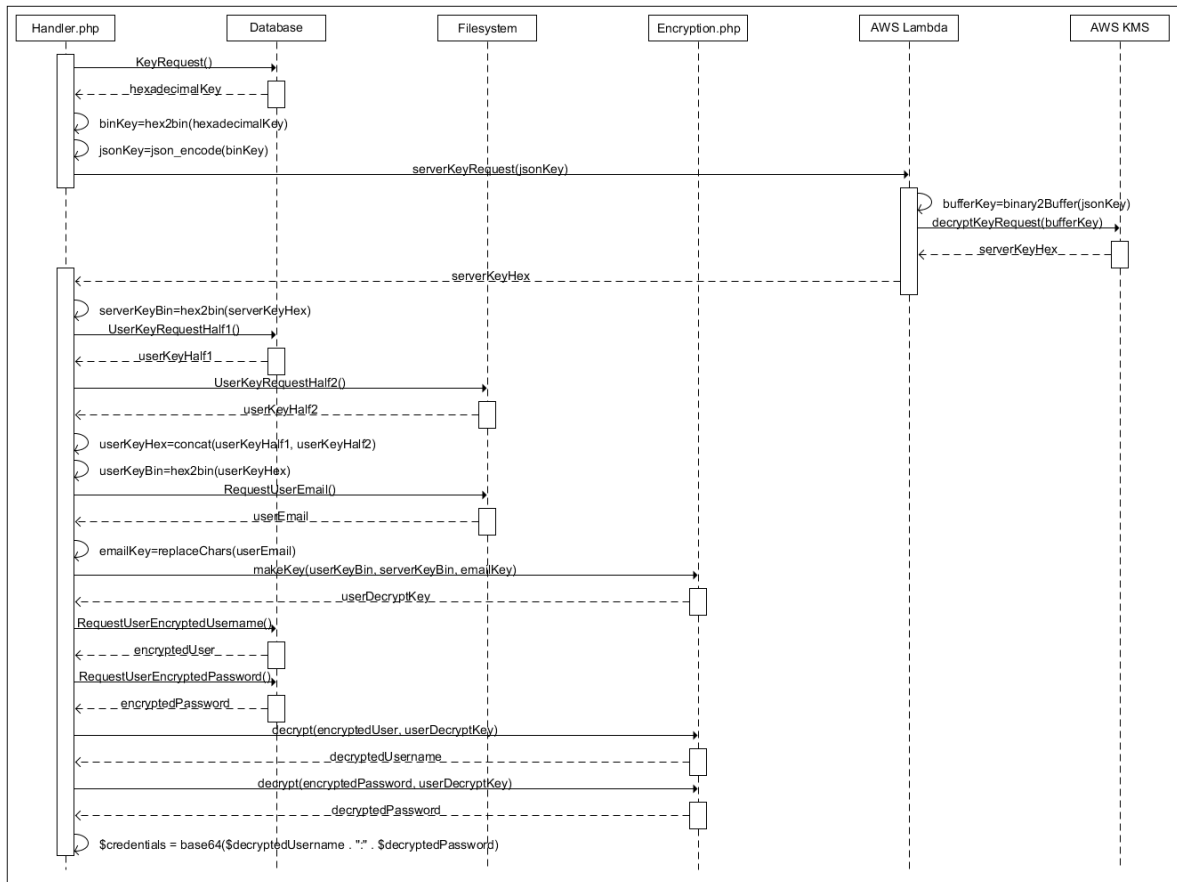
*"AWS Lambda is a compute service where you can upload your code to AWS Lambda and the service can run the code on your behalf using AWS infrastructure."*

AWS Lambda allows us to run code remotely and securely, because nobody ever will get access to source code of this part. And in conjunction with this service, we are also using KMS service to manage encryption keys:

*"AWS Key Management Service (KMS) is a managed service that makes it easy for you to create and control the encryption keys used to encrypt your data, and uses Hardware Security Modules (HSMs) to protect the security of your keys."*

This code would handle to part of the encryption algorithm, making it harder for hackers to decrypt our sensitive data. The key used to encrypt and decrypt is the result of concatenation between three different keys: one has to do with each e-mail (stored directly on database), other we can call **User Key** (on HEX format, half split on a file on file system's root and the other half on database) and **Server Key** (the only way to get is through AWS Services). **AWS KMS** has a Master Key that we use to encrypt and decrypt our **Server Key**, that is stored on our Filesystem (encrypted and formatted on HEX format). Whenever we need to perform any operation that needs User credentials, we will send that encrypted key to **AWS Lambda** (which will send it to AWS KMS to get decrypted). The response will be the **Server Key** decrypted. All this process is minutely described below on the next Figure 4.6.





**Figure 4.6:** Sequence Diagram of Encryption

Figure 4.6 presents the UML Diagram Sequence [45] of credentials retrieve. We can observe that the **first aspect** the script takes care of is to request the key (stored in the Database), that will be used to request the Server Key to AWS Lambda (which will then communicate with AWS KMS to get it). Note that AWS Lambda only accepts calls from this server's IP. **After this**, Handler file will ask for the User's decryption key, which is half stored between Database and Filesystem. And later, the User's e-mail to get the third and last needed key. **Then**, a key will be made by calling *makeKey* from our Encryption class with **User Key, Server Key and E-mail Key** as arguments — this key is the only one that can decrypt this unique User information. At that moment the System is going to get the encrypted Pinnacle's Username and Password of this User and use the *decrypt* method of the Encryption class, along with his decryption key, getting as response both Username and Password, fully decrypted. To conclude, our script will create a string in the format *"username:password"* and transform it onto base64 format (the one needed to make API calls through Pinnacle).

```

1 'use strict';
2 var AWS = require('aws-sdk');
3
4 exports.handler = function(event, context) {
5     var encryptedKey = event.encryptedKey;
6     var kms = new AWS.KMS();
7     var bytes = [];
8
9     for(var i=0; i< encryptedKey.length-1; i+=2){
10         bytes.push(parseInt(encryptedKey.substr(i, 2), 16));
11     }
12     var bufferKey = String.fromCharCode.apply(String, bytes);
13     var bufferArray = bufferKey.split('').map(Number);
14     var finalBuffer = new Buffer(bufferArray);
15
16     var params = {
17         CiphertextBlob: finalBuffer
18     };
19     kms.decrypt(params, function(errr, data) {
20         if (errr) console.log(errr, errr.stack);
21         else {
22             context.done(null, data.Plaintext.toString('utf-8'));
23         }
24     });
25
26 };

```

Figure 4.7: AWS Lambda code

Figure 4.7 shows the piece of code that AWS Lambda is running. We can notice that a key is received as argument and then converted to *Buffer format* — the one needed to get the Server Key decrypted in the end, after calling *decrypt* function from KMS.

Besides these requirements, SSL (Secure Socket Layer) protection [46] is a must, and should take part of the Future Work, in order to avoid Man in the Middle attacks when these kind of information is requested. After everything was greatly working on this part, we felt like some new great features might be implemented, hence we decided to develop a **Betting Interface** with some tools to help all bettors.

#### 4.2.2.D Betting Interface

Following the needs of new bettors and even experienced bettors, we built a page where each user may place bets using our platform on Pinnacle, pretty much the same way it is done on Pinnacle website.

The big differences are that for each market we calculate the payout percentage which can be useful to know how much percentage Pinnacle is earning with that market (also, the more percentage they take, the hardest will be to find value bets on that market — usually for secondary leagues and tournaments, that percentage is higher).

That payout percentage is calculated as follows: 
$$\frac{1}{\left(\sum_{n=1}^n \frac{1}{nOdds}\right)}$$

As  $\frac{1}{odds}$  is the probability of an outcome to happen, we will sum all possible outcomes probability and then  $\frac{1}{probability}$  to get the Payout percentage. Also, we have added the possibility to hedge every bet on every market you choose, in order to guarantee profit or reduce the possible loss. After an high number of tries and research, we finally discovered how to calculate the amount needed to place to **Hedge** a certain bet. The simplest example is to take a match where only two different outcomes may happen, as it follows.

**Table 4.1:** Win-Lose-Profit table

Outcome	Win	Lose	Profit
Team 1	pp	x	pp - x
Team 2	odds <sub>m</sub> * x	r	(odds <sub>m</sub> * x) - r

To Hedge a bet, we must have already placed one before. Table 4.1 should be read as **pp** — Possible profit; **r** — Risk (to win **pp**); **odds<sub>m</sub>** — (*Team2odds* - 1) to correspond only to the possible profit on Team2; And **x** — The value to calculate. The first bet was placed on Team 1, risking **r** € to win **pp** €. Hedging a bet means that the profit on both outcomes should be the same, hence we should solve this equation:  $pp - x = (odds_m * x) - r$  Which will become:  $x = (pp + r) / odds$ . This way we are able to know how much we should bet to Hedge and we can easily calculate how much we can guarantee by now calculating  $Hedge = pp - x$ . The calculation can get harder when there are more than two outcomes. We can observe on Figure 4.8 the function that handles the Hedge calculation (how much a user can guarantee at that moment and how much he should be on other outcomes to achieve it).

```
function calculateHedge(teams, actual_profit, odds){
  for (i = 0; i < teams.length-1; i++) {
    if(parseFloat(actual_profit[i]) > parseFloat(actual_profit[i+1])){
      valorApostar = (parseFloat(actual_profit[i]) - parseFloat(actual_profit[i+1]))/odds[i+1];
      actual_profit[i+2] -= valorApostar;

      if(i == 0){
        valorApostarArray.push(0);
      }
      valorApostarArray.push(valorApostar);

      var lp = parseFloat(actual_profit[i+1]) + (valorApostar * (parseFloat(odds[i+1])-1));
      actual_profit[i] = lp;
      actual_profit[i+1] = lp;
    } else if(parseFloat(actual_profit[i]) < parseFloat(actual_profit[i+1])){
      valorApostar = (parseFloat(actual_profit[i+1]) - parseFloat(actual_profit[i]))/odds[i];
      actual_profit[i+2] -= valorApostar;

      valorApostarArray.push(valorApostar);
      if(i == 0){
        valorApostarArray.push(0);
      }

      var lp = parseFloat(actual_profit[i]) + (valorApostar * (parseFloat(odds[i])-1));
      actual_profit[i] = lp;
      actual_profit[i+1] = lp;
    } else {
      console.log('Nada a fazer');
    }
  }
  valorApostarArray.splice(0, 0, lp);
  return valorApostarArray;
}
```

**Figure 4.8:** Javascript calculateHedge() function

When that happens we decided to group outcomes two by two and apply the procedure explained above. Imagine there are three possible outcomes, we group Outcome 1 and 2 and calculate how much we can guarantee and then we do that again by calculating the Hedge between the previous result (Outcome 1 and 2) with Outcome 3.

That **grouping action** is achieved on Javascript using the **for cycle**, that will run depending on how many outcomes exist (if there is only 2 outcomes, the cycle will be done only once). Function arguments are three different arrays: **teams, actual profit and odds**, that will contain on index 0 the first outcome name, its possible profit (or risk) at the moment and the current odds — all the information needed to calculate the Hedge.

It is rare, but whenever there are more than 3, we keep doing this method until we get the final response. In this case, this Javascript function will return an array where the first index (index 0) corresponds to possible profit if we hedge at that moment and the following indexes will correspond to how much we should bet (it will be done automatically) on each existent Outcome.

#### 4.2.2.E CRON Job

Cron job makes possible to run specific commands (or group of commands), automatically from time to time [39] — it can be set to run at any interval of time, being the minimum one minute.

This feature can be useful for a big variety of purposes. Following the definition of value betting, we decided to add a new great functionality. Imagining we know the Tennis players (or any other Sports teams) listed on Figure 4.9, we know their value and we saw their performance on those matches. With some experience we can predict what should be the odds of each player on the next round when they play against each other.

16:10	Terminado	<b>Tsurenko L. (Ukr)</b>	<b>2</b>	7	6	
		Wang Y. (Chn)	<b>0</b>	5	3	
16:15	Terminado	Rodina E. (Rus)	<b>1</b>	7 <sup>7</sup>	2	2
		<b>Cibulkova D. (Svk)</b>	<b>2</b>	6 <sup>5</sup>	6	6

**Figure 4.9:** Tsurenko's and Cibulkova's Scores

Figure 4.9 shows the exact result from two different Women Tennis matches: Lesia Tsurenko versus Yafan Wang (2-0 on sets) and Evgeniya Rodina against Dominica Cibulkova (2-1 on sets). After this, we guess Tsurenko L. has at least 27% of chance to win the match against Cibulkova D. which means any odds higher than  $1/0.27 = 3.70$  have value.

## Tsurenko L. - Cibulkova D.

Today, 02 Sep 2016, 17:30

Home/Away		AH	O/U	CS	O/E
Full Time		1st Set	2nd Set		
Bookmakers	1	2	Payout		
10Bet	10Bet	3.40	1.33	95.6%	
Luxbet	Luxbet				
Marathonbet	Marathonbet				
mybet	mybet				
NetBet	NetBet				
NordicBet	NordicBet				
Noxwin	Noxwin				
OddsRing	Oddsring				
OtoBet.com	OtoBet				
Pinnacle	Pinnacle	3.45	1.37	98.1%	
RealDealBet	RealDealBet	3.40	1.33	95.6%	
redbet	Redbet	3.40	1.29	93.5%	
SBOBET	SBOBET	3.12	1.35	94.2%	

02 Sep, 15:59 3.45 -0.08  
 02 Sep, 15:56 3.53 -0.03  
 02 Sep, 14:45 3.56 -0.02  
 02 Sep, 08:32 3.58 -0.04  
 02 Sep, 05:36 3.62 -0.14  
 01 Sep, 00:28 3.76 +0.05  
 31 Aug, 23:11 3.71 +0.15  
 31 Aug, 21:39 3.56 +0.07  
 31 Aug, 21:35 3.49 -0.56

Opening odds:  
 31 Aug, 21:17 4.05  
 Click to BET NOW

Figure 4.10: Tsurenko - Cibulkova odds

Odds for this match were released at 31 August 21:17 on Pinnacle Sports with odds 4.05 on Tsurenko's victory as we can notice on Figure 4.10. If we only notice this on 2nd September in the morning, we can see her odds were already around 3.58, which did not have any value already.

Let us imagine two different scenarios where we would bet 1000€ on this outcome anyway (and the bet is settled as won). The first, we bet in the morning at 3.58 odds, we get  $1000 * 3.58 - 1000 = 2580$ € of profit; The second, we bet in the first 18 minutes before the first odds drop, we would profit  $1000 * 4.05 - 1000 = 3050$ €. A simple difference of minutes (or couple of hours) represents  $(3050/2580 - 1) * 100 = 18.22\%$  of higher or lower profit on this single match.

Then we create a Cron Job using the command: `curl -s http://eyebetting.com/cronSearch.php` that executes the script on the PHP file every 5 minutes. The script will search for any previously inputted matches on the Database Table `drcq_Autobetting` and check if the match and the market selected are already available to bet using Pinnacle API. If opening odds are bigger than the odds a certain user selected for that match, a bet will be placed automatically at the best odds available at that time, guarantying the maximum possible profit.

### 4.2.3 Back-End

After understanding well how PHP really behaves, we created a handle file (PHP written) to Ajax Post all kind of necessary requests from the Front-End. Almost every response contains HTML code with specific replied by Back-End in order to be completely printed somewhere on the website page, however there are also responses that contains an Array, that will be handled using Javascript or JQuery on the origin request file (Front-End).

As the most important component on our Back-End is our Database and its structure, the following Figure 4.11 shows how it is logically organized. We can see that each one has an ID as its Primary Key (PK) and most of them a **uid** as Foreign Key (FK), as it follows on the Figure 4.11.

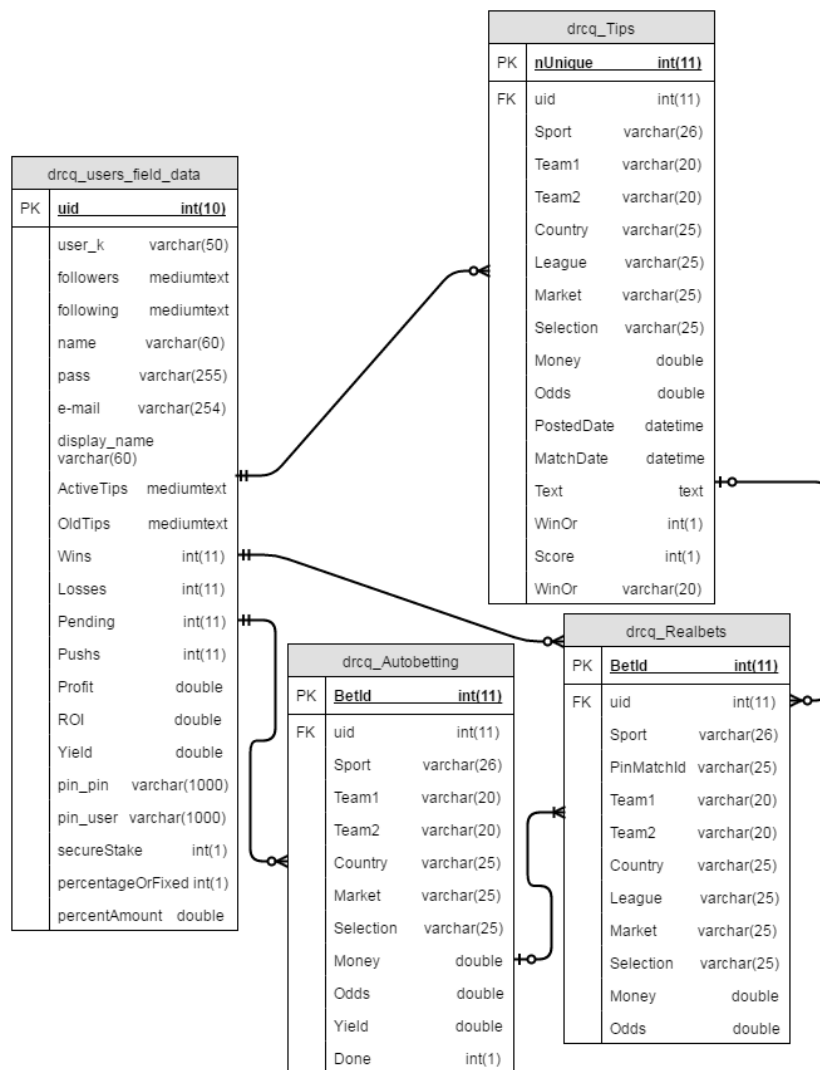


Figure 4.11: Database Tables

*drcq\_users\_field\_data* table is the one holding each users data, such as his name, followers, user-name, e-mail or encrypted Pinnacle username and password; *drcq\_Tips* is responsible for storing all Tips details, so the system can place bets automatically, along with the first table's help; *drcq\_Autobetting* is similar to Tips table, but its goal is to be used by the CRON Job to place future bets; And on *drcq\_Realbets* will be stored all real bets a certain User placed through our System (from copying Tips, from our Betting Interface or from our Autobetting subsystem).

Most of relationships are one-to-many, since each User may post many tips, for example. The exceptions are the relationships between Autobetting and Tips with Realbets, because it is possible for a certain User can have some Real Bets with the necessity of having a single Tip or Autobetting entry.





# 5

## System's Evaluation

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The pre-condition existent for each Testing Task is the need to log in a fresh new account in the System before any tests are made. These Test Case tables can be observed on the following four tables.

**Table 5.1: Test Case 1**

<b>Test Case 1</b>	Creating a new Tip (on match Napoli - Benfica)
<b>Actors</b>	User (He is also a Tipster)
<b>Scenario</b>	<ol style="list-style-type: none"> <li>1. User goes to "New Tip" page</li> <li>2. User searches match "Napoli – Benfica" and go to its page</li> <li>3. User chooses to place a bet on Over 2.5 goals with no text</li> <li>4. User reads all details about match and confirm the Tip</li> <li>5. User goes to "Tips" page and confirm that Tip is on the Active Tips list</li> </ol>

**Table 5.2: Test Case 2**

<b>Test Case 2</b>	Set new Future Bet (on match Napoli - Benfica)
<b>Actors</b>	User
<b>Scenario</b>	<ol style="list-style-type: none"> <li>1. User goes to "Autobetting" page</li> <li>2. User selects "Football" as Sport, "Napoli" as Home Team, "Benfica" as Away Team, "Champions" as League, "Moneyline" as Market, "1" as Outcome, "2.2" as Odds, "100" as Amount</li> <li>3. User submits the Future bet</li> <li>4. User reads all details about future match and confirm it</li> <li>5. A popup is shown with <i>success</i> message</li> </ol>

**Table 5.3: Test Case 3**

<b>Test Case 3</b>	Follow a Tipster and copy his Tip
<b>Actors</b>	User
<b>Scenario</b>	<ol style="list-style-type: none"> <li>1. User searchs Tipster "TesteAcc"</li> <li>2. User follows him</li> <li>3. User copies his Tip "AEL Limassol" to win that match at odds 1.6</li> <li>4. A popup is shown stating that he has no Pinnacle account linked</li> </ol>

**Table 5.4: Test Case 4**

<b>Test Case 4</b>	Place a Real Bet (on match Napoli - Benfica)
<b>Actors</b>	User
<b>Scenario</b>	<ol style="list-style-type: none"> <li>1. User goes to "Betting Interface" page</li> <li>2. User selects "Football" as Sport, "Champions League" as League, "Napoli – Benfica" as Match</li> <li>3. User tries to bet 5€ on Benfica to Win the match (Moneyline)</li> <li>4. A popup is shown stating that he has no Pinnacle account linked</li> </ol>

For each one of them, we decided to write a Scenario to each Test Case, in order to exemplify them better, as it follows.

### Scenario Use Case 1

Luigi, supporter of Inter Milan, knows well Napoli and Benfica, and after analyzing the match odds, he feels that there is value on betting on a couple of goals being scored. He goes to **New Tip** page and starts **searching for Napoli - Benfica** match (Luigi can achieve this by typing on search bar or by clicking on Football, then Europe and then Champions League). When inside match page containing all odds and markets existent on Pinnacle, Luigi will **choose to bet on Over 2.5 Goals**. Then he will submit it and visit **Tips page** and verify that his Tip really is on **Active Tips list**.

### Scenario Use Case 2

Luigi, supporter of Inter Milan, knows well Napoli and Benfica, and match odds have not been set yet. He knows that Napoli should smash Benfica in this match, because they are playing home and Benfica will rest some players. After looking better into this match, he feels that any odds higher than 2.20 for Napoli win is a must-bet situation. He goes to **Autobetting** page and then **selects the details** “Football” as Sport, “Napoli” as Home Team, “Benfica” as Away Team, “Champions” as League, “Moneyline” as Market, “1” as Outcome, “2.2” as Odds, “100” as Amount. Luigi **confirms** twice what he selected and wrote, and submit the future bet. When Pinnacle opens their odds for this match, if Napoli odds are set over 2.20, the system will automatically bet 100€ on it.

### Scenario Use Case 3

Someone told João that Luigi is a great Tipster, with a nice ROI (Return on Investment) and he wants to follow his tips to bet with real money. So João searches for Luigi (his Display name is *TesteAcc*), he goes to **Tips page** (he can also visit **Tipsters** page), he find his last tip where he **follows him** and then João chooses to **copy his Tip** on AEL Limassol to win that match at odds 1.6.

### Scenario Use Case 4

João is willing to bet on Benfica with the possibility to hedge his bet if Benfica scores a goal, so he goes to **Betting Interface** page and selects **match details** “Football” as Sport, “Champions League” as League, “Napoli – Benfica” as Match. After the markets are loaded into the page, he decides to **bet 5€** on Benfica to win the match (Moneyline market).

## 5.1 Questionnaire

Following these four Test Cases and its Scenarios, we design a test to be made to a number of user to evaluate the System's usability and functionality.

### 5.1.1 Steps

In the next Table 5.5 we present the steps of Testing procedure. **Then**, there is the list of all 14 sub-tasks (sub-section **5.1.1.A User Tasks** below) the User must perform to finish the System's Testing along with how much time they are expected to spend on each.

**Table 5.5:** Evaluation Steps

Step Number	Description
1	Provide the initial form to identify the type of user
2	Explaining and showing the system for about 5 minutes
3	Read each scenario to the users (in a global way), then a bit more detailed and let them perform
4	Sometimes mix the order of the tasks for each user
5	Metrics for scenario: duration time, completion within the expected time interval and observations
6	Final questionnaire - Aimed at qualifying our System's usability easiness

#### 5.1.1.A User Tasks

##### 1. Create a New Tip

- 1.1. Go to New Tip page - 5 seconds
- 1.2. Find match "Napoli – Benfica" and go to its page - 45 seconds
- 1.3. Choose to place a bet on Over 2.5 goals with no text - 10 seconds
- 1.4. Read all details about match and confirm the Tip - 8 seconds
- 1.5. Go to "Tips" page and confirm that Tip is on the Active Tips list - 6 seconds

##### 2. Autobetting

- 2.1. Go to "Autobetting" page – 5 seconds
- 2.2. Select "Football" as Sport, "Napoli" as Home Team, "Benfica" as Away Team, "Champions" as League, "Moneyline" as Market, "1" as Outcome, "2.2" as Odds, "100" as Amount- 20 seconds
- 2.3. Submit the Future bet - 5 seconds
- 2.4. Read all details about future match and confirm it - 8 seconds

### 3. Follow a Tipster

3.1. Find Tipster “TesteAcc” – 10 seconds

3.2. Follow him - 5 seconds

3.3. Copy his Tip “AEL Limassol” to win that match at odds 1.6 – 7 seconds

### 4. Place a Real Bet

4.1. Go to “Betting Interface” page – 5 seconds

4.2. Select “Football” as Sport, “Champions League” as League, “Napoli – Benfica” as Match – 15 seconds

4.3. Try to bet 5€ on Benfica to Win the match (Moneyline) – 12 seconds

## 5.1.2 Testers Characterization

Following the evaluation of our 22 Tester’s initial form responses (Tables 5.6 and 5.7 below).

**Table 5.6:** Initial questionnaire answers - Part 1

Question	Gender		Age			Academic studies			
	Male	Female	18-25	26-35	36-50	Science/ Engineering	Humanities and Social Sciences	Health Sciences	Other
<b>Options</b>									
<b>Number of</b>	19	3	14	5	3	13	2	2	5
<b>Percentage</b>	86	14	64	23	13	59	9	9	23

**Table 5.7:** Initial questionnaire answers - Part 2

Question	Academic Degree					Betting Knowledge?	
	Did not complete High School	High School	Bachelor’s Degree	Master’s Degree	Adv. Graduation or Ph.D.	Yes	No
<b>Options</b>							
<b>Number of</b>	0	5	11	6	0	6	16
<b>Percentage</b>	0	23	50	27	0	27	73

We can conclude that most of them are **Male**, **18-25** years old with their academic studies on **Science/Engineering**. Most of them already have a **Bachelor’s Degree** and, unfortunately, **only 27%** of them already **had Betting Knowledge**.

### 5.1.3 Testing Results

The following tables 5.5, 5.6, 5.7 and 5.8 correspond to the four Test Cases statistics of our 22 Testers — It shows how long (in seconds) it was expected each User to perform each Sub-Task and then it presents the minimum, maximum, range (difference between minimum and maximum values), median, mean and mode values for them.

**Table 5.8:** Test Case 1 Statistics

<b>Test Case 1</b>	<b>Create a New Tip</b>				
<b>Sub-Tasks</b>	1.1	1.2	1.3	1.4	1.5
<b>Expectation</b>	5	45	10	8	6
<b>Mean</b>	5.27	43.73	12.82	8.64	8.41
<b>Minimum</b>	2	25	6	5	4
<b>Maximum</b>	11	65	20	14	15
<b>Range</b>	9	40	14	8	11
<b>Median</b>	5	40.5	12	8	8.56
<b>Mode</b>	5	40	10	7, 8	6, 11, 9

**Table 5.9:** Test Case 2 Statistics

<b>Test Case 2</b>	<b>Autobetting</b>			
<b>Sub-Tasks</b>	2.1	2.2	2.3	2.4
<b>Expectation</b>	5	20	5	8
<b>Mean</b>	5.23	25.68	4.32	7.41
<b>Minimum</b>	3	16	2	4
<b>Maximum</b>	8	40	7	12
<b>Range</b>	5	24	5	8
<b>Median</b>	5	24.5	4	7.5
<b>Mode</b>	5	22	4, 5	5, 8

**Table 5.10:** Test Case 3 Statistics

<b>Test Case 3</b>	<b>Follow a Tipster</b>		
<b>Sub-Tasks</b>	3.1	3.2	3.3
<b>Expectation</b>	10	5	7
<b>Mean</b>	13.36	5.86	8.59
<b>Minimum</b>	7	2	4
<b>Maximum</b>	31	11	14
<b>Range</b>	24	9	10
<b>Median</b>	12	5.5	8.5
<b>Mode</b>	12	5	8, 10



**Table 5.11: Test Case 4 Statistics**

<b>Test Case 4</b>	<b>Betting Interface</b>		
<b>Sub-Tasks</b>	4.1	4.2	4.3
<b>Expectation</b>	5	15	12
<b>Mean</b>	5.18	16.09	12.45
<b>Minimum</b>	2	11	7
<b>Maximum</b>	8	26	18
<b>Range</b>	6	15	11
<b>Median</b>	5	16	13
<b>Mode</b>	5	12, 16	13

After analyzing them, we have reached to some conclusions, as it follows on the next paragraphs.

- Test Case 1 — Every sub-task mean time (in seconds) is very close to the expectation. However, on almost each one there is a small deviation of the its *maximum*. This was mainly caused because of the absence of Betting (or Sports) Knowledge from few Testers.
- Test Case 2 — As the first use case, every mean value is close to the expected one. There is an higher variance on the values on Sub-Task 2.2 because of writing time of each user.
- Test Case 3 — This Use Case could be completed from two different ways: using Tipsters page or Tips page (to find the Tipster). Testers who opted to do it using the first option tended to take longer to finish each Sub-Task. However, mean value is good.
- Test Case 4 — This Use Case was never the first to be done and, because of that, we noticed our Testers were more confident, not hesitating too much to complete any of its Sub-Tasks. Mean values were almost perfect, comparing with the expected time.

Overall, we may conclude that our platform is showing great levels of Usability. Almost every User perform everything successfully with relatively easiness.

**Table 5.12: Overview Questionnaire Statistics**

<b>Question</b>	<b>1</b>			<b>2</b>			<b>3</b>			<b>4</b>		
<b>Statistics</b>	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
<b>Easy to Use</b>	<b>3.81</b>	3	5	<b>4</b>	3	5	<b>3.59</b>	3	5	<b>4.23</b>	4	5
<b>Easy to Understand</b>	<b>3.86</b>	2	5	<b>4.14</b>	4	5	<b>3.14</b>	2	4	<b>4.09</b>	3	5

Table 5.9 show the statistics of our Overview Questionnaire, where we can observe the Minimum, Maximum and Mean values (from 1 to 5) gathered from our 22 Testers evaluation of Easiness of Use and Understanding. It is possible to visualize that the values from both types of evaluation are similar along the four Test Cases, and always positive and higher than the medium value (3).



# 6

## Conclusion

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Motivated by the growth of the Online Gambling all over the World, several small companies have been trying to help bettors to improve their betting results with the encouragement of information sharing between users on these platforms or by providing them some little tools. This kind of platforms have seen their number of users raising day by day, due to the huge increase of Online Gambling popularity.

Nonetheless, there are still some things that may be improved on these platforms so that their users may also maximize their results. In particular, the way they manage their bets and their bankroll and the huge amount of time almost every bettor takes to *copy* a **value bet** from another Tipster. Considering these two well-related issues, this project was successfully developed fixing these problems by **following a Staking Plan** when **placing** (or copying) **bets automatically**, bringing advantages to the bettors who use it. This way the process of copying a bet from other bettors is fully optimized, replacing the need to place bets totally manually, as it happens nowadays.

This project also contains other two subsystems that are intended to ease some betting aspects, with the use of Autobetting page to automatically place bets upon odds release and Betting Interface which allows any user to place and hedge bets on Pinnacle Sports.

## 6.1 Future Work

At this moment Pinnacle Sports is the only Sportsbook used through our System, we will also integrate William Hill (which has an API) and other well-known Sportsbooks (e.g Bet365, 188Bet and SBOBet) that do not have an API available. This way user will be able to create Tips from a wider range of Bookmakers. At that point, we will improve Autobetting and our Betting Interface Sub-Systems with these new Bookmakers.

We are also planning to display graphs on each Tipster profile to make easier to observe their statistics over time and provide the possibility to customize more settings on their profile. Another feature we would like to implement is the creation of a Chat System similar to Facebook (each User will be able to chat with each other on 1-to-1 communication and to create chat rooms).

Last but not less relevant, in order to reward our Tipsters, we will design and develop a Reward System based on how many Users are following each Tipster (and how much they are betting on average) — similarly to eToro system [47], where they classify their Traders in three different categories — Rising Star Trader, Champion Trader and Elite Popular Investor Trader.



# Bibliography

- [1] Jackson, D. A. (1994). Index betting on sports. The Statistician, 309-315.
- [2] Number of Internet Users (2015) - Internet Live Stats, "Internet Users in the World" Internet: <http://www.internetlivestats.com/internet-users/> [last accessed: Nov. 1, 2015], 2015.
- [3] R. Antunes, S. Freches "Apostas online legalizadas ate ao fim do ano mas com controlo da Santa Casa" in Diario de Noticias, July 2012.
- [4] Spann, M., & Skiera, B. (2009). Sports forecasting: a comparison of the forecast accuracy of prediction markets, betting odds and tipsters. Journal of Forecasting, 28(1), 55.
- [5] Paul, R. J., & Weinbach, A. P. (2012). DOES SPORTSBOOK. COM SET POINTSPREADS TO MAXIMIZE PROFITS?. The Journal of Prediction Markets, 1(3), 209-218.
- [6] Bookmakers Review, "How to Choose an Online Sportsbook" Internet: <https://www.bookmakersreview.com/how-choose-online-sportsbook/> [last accessed: Nov. 15, 2015], 2015.
- [7] Bet Stories, "Why Flat Betting is the best staking plan to start with" Internet: <http://www.betstories.com/2014/01/03/best-staking-plan/> [last accessed: Nov. 27, 2015], 2015.
- [8] OLBG, "Staking Plans" Internet: <http://www.olbg.com/school/lesson18.htm> [last accessed: Nov. 27, 2015], 2015.
- [9] Draw No Bet, "Staking Plans – The Good, the Bad and the Downright Ugly" Internet: <http://www.drawnobet.com/staking-plans/> [last accessed: Nov. 27, 2015], 2015.
- [10] Phatarfod, R. (2011). Further aspects of gambling with the Kelly criterion. The Mathematical Scientist [P], 36(1), 47-56.
- [11] Teoh, K. T., Ng, S. P. Y., Khoo, H. R., Voon, S. Y., & Yeep, P. L. (2015). Effectiveness of martingale strategy in gambling and investment (Doctoral dissertation, UTAR).

- [12] BBC News, "How does a betting exchange work?" Internet: [http://news.bbc.co.uk/2/hi/uk\\_news/7109494.stm](http://news.bbc.co.uk/2/hi/uk_news/7109494.stm) [last accessed: Dec. 8, 2015], 2007.
- [13] Galindro, A. A. P. (2012). Diversificacao e cobertura de risco atraves de apostas desportivas.
- [14] Haigh, J. (2000). The Kelly criterion and bet comparisons in spread betting. Journal of the Royal Statistical Society: Series D (The Statistician), 49(4), 531-539.
- [15] Barros, C. (2012). Simulacao de Estrategias de Apostas Desportivas com Cobertura de Perdas.
- [16] Buchdahl, J. (2003). Fixed odds sports betting. High Stakes.
- [17] Betting Resource, "But what about martingale betting system?" Internet: <http://bettingresource.com/do-betting-systems-work.html> [last accessed: Dec. 14, 2015], 2010.
- [18] Staking Plans, "1326 Staking Plan" Internet: <http://stakingplan.com.au/1326-staking-plan/> [last accessed: Dec. 14, 2015], 2012.
- [19] Staking Plans, "Fibonacci Staking Plan" Internet: <http://stakingplan.com.au/fibonacci-staking-plan/> [last accessed: Dec. 14, 2015], 2012.
- [20] Staking Plans, "D'Alembert Staking Plan" Internet: <http://thestakingmachine.com/dalembert.php/> [last accessed: Dec. 14, 2015], 2012.
- [21] Staking Plans, "Percentage Staking Plan" Internet: <http://stakingplan.com.au/percentage-staking-plan/> [last accessed: Dec. 14, 2015], 2012.
- [22] Staking Plans, "Secure Staking Plan" Internet: <http://stakingplan.com.au/secure-staking-plan/> [last accessed: Dec. 14, 2015], 2012.
- [23] Staking Plans, "1326 Staking Plan" Internet: <http://stakingplan.com.au/1326-staking-plan/> [last accessed: Dec. 14, 2015], 2012.
- [24] Thorp, E. O. (1998). The Kelly criterion in blackjack, sports betting, and the stock market. Finding the Edge: Mathematical Analysis of Casino Games, 1(6).
- [25] Gonçalves, R., Rocha, A. P., & Pereira, F. L. (2013). High Level Architecture for Trading Agents in Betting Exchange Markets. In Advances in Information Systems and Technologies (pp. 497-510). Springer Berlin Heidelberg.
- [26] Pinnacle Sports, "How to hedge a bet for guaranteed profit" Internet: <https://www.pinnacle.com/en/betting-articles/pinnacle.pinnaclesports.models.sport/how-to-hedge-a-> [last accessed: Oct. 12, 2016], 2016.



- [27] Deschamps, B., & Gergaud, O. (2008). Efficiency in Horse Races Betting Markets: The Role of Professional Tipsters. Handbook of Sports and Lottery Markets, 341-354.
- [28] Smith, M. A. (2003). The Impact of Tipster Information on Bookmakers' Prices in UK Horse-Race Markets. The Economics of Gambling, 67-78.
- [29] Bernardo, G., Ruberti, M., & Verona, R. (2015). Testing semi-strong efficiency in a fixed odds betting market: Evidence from principal European football leagues.
- [30] Sung, M. C., Johnson, J. E., & Bruce, A. C. (2005). Searching for semi-strong form inefficiency in the UK racetrack betting market. Information Efficiency in Financial and Betting Markets (Cambridge: Cambridge University Press, 2005) pp, 179-192.
- [31] Croxson, K., & James Reade, J. (2014). Information and efficiency: Goal arrival in soccer betting. The Economic Journal, 124(575), 62-91.
- [32] Turner, N. E., & Horbay, R. (2003). Doubling revisited: The mathematical and psychological effect of betting strategy. Gambling Research: Journal of the National Association for Gambling Studies (Australia), 15(2), 16.
- [33] Blanco, C., Moreyra, P., Nunes, E. V., Saiz-Ruiz, J., & Ibanez, A. (2001, July). Pathological gambling: addiction or compulsion?. In Seminars in clinical neuropsychiatry (Vol. 6, No. 3, pp. 167-176).
- [34] Nassi, I., & Shneiderman, B. (1973). Flowchart techniques for structured programming. ACM Sigplan Notices, 8(8), 12-26.
- [35] Reiss, E. (2012). Usable usability: simple steps for making stuff better. John Wiley & Sons.
- [36] Kambalyal, C. (2010). 3-tier architecture. Retrieved On, 2.
- [37] Tomlinson, T. (2010). Beginning Drupal 7. Apress.
- [38] Bermudez, I., Traverso, S., Mellia, M., & Munafo, M. (2013, April). Exploring the cloud from passive measurements: The Amazon AWS case. In INFOCOM, 2013 Proceedings IEEE (pp. 230-234). IEEE.
- [39] Keller, M. S. (1999). Take command: cron: Job scheduler. Linux Journal, 1999(65es), 15.
- [40] Bevan, N. (1997, August). Usability issues in web site design. In HCI (2) (pp. 803-806).
- [41] Huang, L. S., Weinberg, Z., Evans, C., & Jackson, C. (2010, October). Protecting browsers from cross-origin CSS attacks. In Proceedings of the 17th ACM conference on Computer and communications security (pp. 619-629). ACM.

- [42] StackOverflow, "Two-way encryption" Internet: <http://stackoverflow.com/questions/5089841/two-way-encrypt> [last accessed: Oct. 12, 2016], 2011.
- [43] Qaisar, S., & Khawaja, K. F. (2012). Cloud computing: network/security threats and countermeasures. Interdisciplinary journal of contemporary research in business, 3(9), 1323.
- [44] Clark, S., Goodspeed, T., Metzger, P., Wasserman, Z., Xu, K., & Blaze, M. (2011, March). One-way cryptography. In International Workshop on Security Protocols (pp. 336-340). Springer Berlin Heidelberg.
- [45] Li, X., Liu, Z., & Jifeng, H. (2004). A formal semantics of UML sequence diagram. In Software Engineering Conference, 2004. Proceedings. 2004 Australian (pp. 168-177). IEEE.
- [46] Kant, K., Iyer, R., & Mohapatra, P. (2000). Architectural impact of secure socket layer on internet servers. In Computer Design, 2000. Proceedings. 2000 International Conference on (pp. 7-14). IEEE.
- [47] Forex Trading, "The Benefits of Becoming an Etoro Popular Investor" Internet: <http://forextrading.com/articles/benefits-becoming-etoro-popular-investor-guru-lead-earn-you> [last accessed: Oct. 12, 2016], 2011.
- [48] Betting Scientist, "How *15quicklymakes157.28* from 5 highly secure bets on favorites" Internet: <http://www.bettingscientist.com> [last accessed: Oct. 13, 2016], 2011.
- [49] Fonseca, Manuel J. et al. 2012. Introdução ao design de interfaces, FCA-Editora de Informática, Lisboa. ISBN: 978-972-722-738-9



## Appendix A

**Table A.1:** Functional Requirements List

<b>Req.</b>	<b>Description</b>
FR1	User should be able to place Tips (becoming a Tipster)
FR2	User should be able to edit his own profile details
FR3	System should keep the record of each Tipster
FR4	User should be able to follow (or unfollow) any Tipster
FR5	User should be able to set a fixed amount or percentage of his bankroll to bet
FR6	User should be able to copy a single bet from Tips list
FR7	System should place real bets (automatically) on the Tipster's followers Pinnacle accounts
FR8	System should present Tipsters ranking along with Sort and Filter options
FR9	User should be able to follow Secure Staking Plan, instead of fixed alternatives
FR10	User should be able to navigate through all Pinnacle matches and markets
FR11	User should be able to place bets directly on Pinnacle through Betting Interface
FR12	User should be able to hedge his bets from Betting Interface
FR13	User should be able to choose future match details to be bet through Autobetting subsystem

## A.1 User profile questionnaire

1. Gender
  - A. Male
  - B. Female
2. Age
  - A. 18-25
  - B. 26-35
  - C. 36-50
  - D. 51+
3. Academic studies
  - A. Science/Engineering
  - B. Humanities and Social Sciences
  - C. Health Sciences
  - D. Other
4. Academic degree
  - A. Did not complete High School
  - B. High School
  - C. Bachelor's Degree
  - D. Master's Degree
  - E. Advanced Graduate work or Ph.D.
5. Betting Knowledge?
  - A. Yes
  - B. No

## A.2 Overview questionnaire form

From 1 - Terrible to 5 - Very good, evaluate our System answering the following four questions:

1. Regarding the the Tips Creation:
  - A. Easy to use
  - B. Easy to understand
2. Regarding setting a Future Bet:
  - A. Easy to use
  - B. Easy to understand
3. Regarding following a Tipster:
  - A. Easy to use
  - B. Easy to understand
4. Regarding placing a Real Bet on Betting Interface:
  - A. Easy to use
  - B. Easy to understand



# B

## Appendix B

The screenshot displays the Betbrain website interface. At the top, there is a navigation bar with a search bar, language selection (English), region selection (EU), and a 'Deduct commission' checkbox. Below this is a secondary navigation bar with dropdown menus for 'Pick sport', 'Pick country', 'Pick tournament', and 'Pick match'. A main navigation bar contains links for 'Odds home', 'LIVE Center', 'Next Matches', 'Free Bets', and 'Help'. The main content area features two match cards: 'Atlanta Dreams (W) - Washington Mystics (W)' for WNBA 2016 with odds of 1.68 and 2.32, and 'FC Jazz Pori - FF Jaro' for Ykkonen 2016 with odds of 1.82 and 2.03. Below the match cards is a pagination control with buttons 1 through 5. The bottom section is divided into three columns: 'Browse Events' with a list of sports (Football, AFL, Am. Football, Baseball, Basketball, E-Sports, Fighting); 'Popular Matches' with a table of upcoming games; and 'Popular Outrights' with a list of betting markets.

Match	Date/Time
Feyenoord Rotterdam - Manchester United FC	15/09/16 18:00
Atlanta Dreams (W) - Washington Mystics (W)	16/09/16 00:00
Phoenix Mercury (W) - Seattle Storm (W)	16/09/16 01:00
FC Jazz Pori - FF Jaro	15/09/16 16:30
APOEL Nicosia FC - FC Astana	Europe

Football	Europe	UEFA Champions League
Football	Europe	UEFA Europa League
Am. Football	United States	NCAA Football
Football	England	Premier League
Ice Hockey	Russia	KHL

Figure B.1: Original Betbrain page

```

$xml_sports = new \SimpleXMLElement($this->get("sports", $credentials)); //get sports function
foreach($xml_sports->sports->children() as $sport){ //iterate sports
    if ((string) $sport == $POST["sport"]){ //sport match
        $param = array("sportid" => (string) $sport->attributes()['id']); //parameters to leagues call
        $xml_leagues = new \SimpleXMLElement($this->get("leagues", $credentials, $param)); //get leagues function
        foreach($xml_leagues->leagues->children() as $league){ //iterate leagues
            if (strpos((string) $league, $POST["league"]) != false){ //league match
                //parameters to fixtures call
                $param = array("sportid" => (string) $sport->attributes()['id'], "leagueids" => (string) $league->attributes()['id']);
                $xml_fixtures = $this->get("fixtures", $credentials, $param); //fixtures call
                $result = json_decode($xml_fixtures, true); //json decode

                foreach ($result['league'] as $row) {
                    foreach ($row['events'] as $events) { //iterate through events
                        if(strpos((string) $events['home'], $lastTeamString) != false && strpos((string) $events['away'],
                            $lastTeamString) != false) { //verify if Home Team and Away Team contains the team String we are looking for

                            if($market == 'TOTAL_POINTS'){//verify the type of market to construct parameters array to call get line,
                                final step
                                $param = array("sportid" => (string) $sport->attributes()['id'], "leagueId" => (string) $league->
                                    attributes()['id'], "eventId" => (string) $events['id'], "betType" => $market, "oddsFormat" => "DECIMAL",
                                    "periodNumber" => $period, "side" => $outcome, "handicap" => $line);
                            } else if ($market == 'MONEYLINE') {
                                $param = array("sportid" => (string) $sport->attributes()['id'], "leagueId" => (string) $league->
                                    attributes()['id'], "eventId" => (string) $events['id'], "betType" => $market, "oddsFormat" => "DECIMAL",
                                    "periodNumber" => $period, "team" => $outcome);
                            } else{
                                $param = array("sportid" => (string) $sport->attributes()['id'], "leagueId" => (string) $league->
                                    attributes()['id'], "eventId" => (string) $events['id'], "betType" => $market, "oddsFormat" => "DECIMAL",
                                    "periodNumber" => $period, "team" => $outcome, "handicap" => $line);
                            }
                            $xml_line = $this->get("line", $credentials, $param);
                            $result = json_decode($xml_line, true);

                            $param = array("uniqueRequestId" => $this->getGUID(),
                                "acceptBetterLine" => "TRUE",

```

Figure B.2: PHP Code to find and place bet on an Outcome



### Picture



 Koala.jpg (2.32 KB)

[Remove](#)

Your virtual face or picture.

### Pinnacle Username

Input your details to place bets automatically. Security and privacy are assured.

### Pinnacle Password

Input your details to place bets automatically. Security and privacy are assured.

### Follow Secure Staking Plan?

- Yes
- No, I want to choose my percentage on the box below

Read more about this strategy at [Staking Plans](#) page.

### Use a fixed percentage of your Betting Bank or fixed stake?

- Fixed Percentage
- Fixed Stake

Your bets will be placed accordingly with your settings here.

### Select fixed percentage or fixed stake value

If you input 5, it will be 5% or 5 on your Pinnacle currency, depending on your last answer.

[Save](#)

Figure B.3: Profile Edit Page




 <p data-bbox="247 851 319 907"> <a href="#">Unfollow</a>            TestAcc         </p>	<p data-bbox="391 694 726 728"><b>AEL Limassol - Ethnikos Achnas FC</b></p> <p data-bbox="391 734 582 768">Cyprus   1. Division</p> <p data-bbox="391 779 598 813">2016-09-12 17:15:34</p>	<p data-bbox="885 694 933 728"><b>1X2</b></p> <p data-bbox="885 734 1013 768">AEL Limassol</p> <p data-bbox="885 779 925 813">1.6</p>	<p data-bbox="1252 716 1364 795">Copy Bet</p>
 <p data-bbox="247 1131 319 1187"> <a href="#">+follow</a>            Teste         </p>	<p data-bbox="391 974 710 1008"><b>Amkar U21 - FK Tom Tomsk U21</b></p> <p data-bbox="391 1014 758 1048">Russia   Premier Reserve League U21</p> <p data-bbox="391 1059 598 1093">2016-09-09 09:43:36</p> <p data-bbox="391 1120 1364 1220">           @Kontaveit Showed in yesterdays match as a very strong and confident in your game . The game very freely without looking back . She is tall and very strong. Wins very confident his service points , playing very aggressively and effectively with the final line of the court. The defensive plays very well on grass courts or very confident they attack each lighter the ball opponent . @Wozniacki Yester [...]         </p>	<p data-bbox="885 974 1109 1008"><b>Asian Handicap, 0,-0.5</b></p> <p data-bbox="885 1014 1077 1048">FK Tom Tomsk U21</p> <p data-bbox="885 1059 933 1093">2.68</p>	<p data-bbox="1252 1008 1364 1086">Copy Bet</p>
 <p data-bbox="247 1411 319 1467"> <a href="#">+follow</a>            Teste         </p>	<p data-bbox="391 1254 710 1288"><b>Amkar U21 - FK Tom Tomsk U21</b></p> <p data-bbox="391 1294 758 1328">Russia   Premier Reserve League U21</p> <p data-bbox="391 1339 598 1373">2016-09-09 09:31:47</p>	<p data-bbox="885 1254 1109 1288"><b>Asian Handicap, 0,-0.5</b></p> <p data-bbox="885 1294 1077 1328">FK Tom Tomsk U21</p> <p data-bbox="885 1339 933 1373">2.68</p>	<p data-bbox="1252 1288 1364 1366">Copy Bet</p>

Figure B.4: Tips Page