

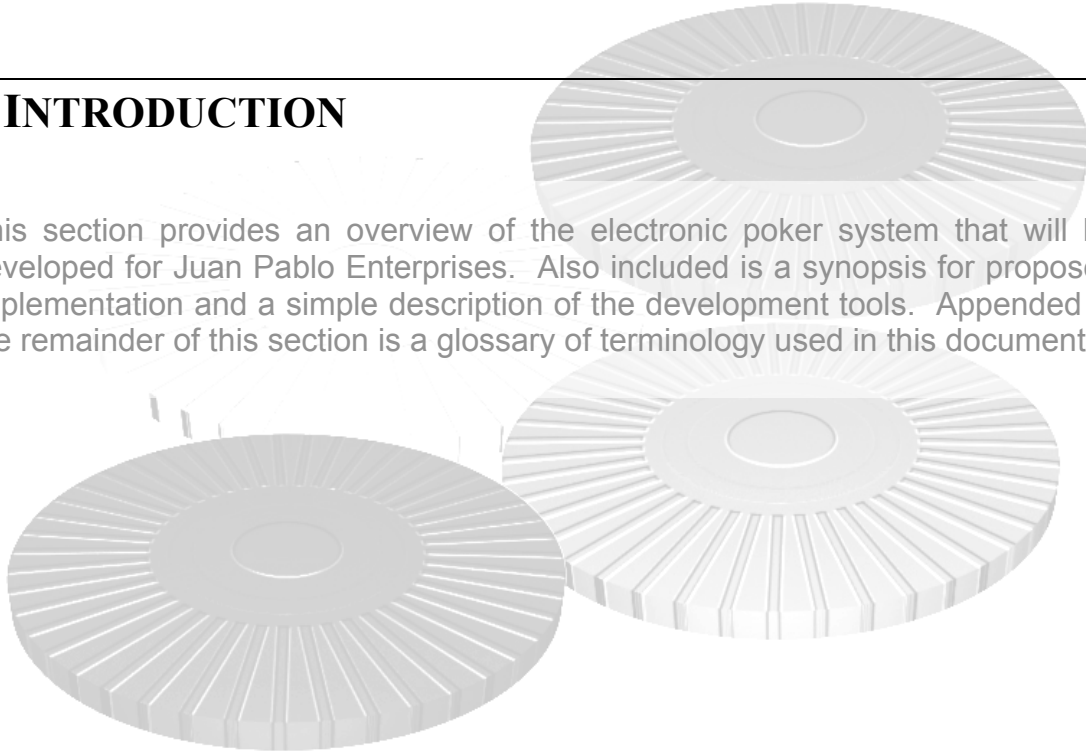


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01 INTRODUCTION

This section provides an overview of the electronic poker system that will be developed for Juan Pablo Enterprises. Also included is a synopsis for proposed implementation and a simple description of the development tools. Appended to the remainder of this section is a glossary of terminology used in this document.



1.1 OBJECTIVE

Designed for Juan Pablo Enterprises, our system is intended to help the enterprise's casinos keep up with the increase in demand for Texas Hold'em Poker. Players will interact with the game through dedicated handheld devices, a change from the casino's existing traditional table play. As such, the system will support a client/server based model that will facilitate the game for which cards will be dealt and players will bet just as they would in the traditional version

1.2 DOCUMENT CONTENTS

This document is a description of the electronic version of the Texas Hold'em poker game. The document contains a full catalog of requirements for the system that have been highlighted with carefully traced use cases. Each use case describes a way to interact with the system from outside of its bounds. In addition, the scope of the project has been formally defined, along with the delegation of responsibilities that will be assumed to be completed by Juan Pablo Enterprises. Finally, major design decisions will be explained.

1.3 RELATIONSHIP TO ROSE MODELS

The system will be developed using the Rational Rose Real-Time development suite. With this suite, software may be designed from a set of diagrams. This is particularly advantageous for a number of reasons. For instance, an expert in the domain of Texas Hold'em poker may verify the correctness of the system, without knowledge of any computer programming languages. This empowers Juan Pablo Enterprises to assess and address concerns during the development of the project. Moreover, the advantages of using diagrams for software development extend beyond the development stage. Should Juan Pablo Enterprises wish to expand the functionality of the electronic poker system, the diagrams may be easily understood and extended by TeamGERM or any other software development firm.

This document should be considered a supplement to the implementation specific documentation found in the "Rational Rose Real-Time model". Please refer to the models for such diagrams as the use case, sequence, structure, and state diagrams.

The relationships between use cases in this document are shown in the use case diagram, found in the UseCaseDiagram, in the Cases package, a part of the Use Case View. The text from the use case descriptions is also included for each use case in the diagram.

The sequence diagrams in the model are used to show in a linear fashion the sequence of messages sent between system components and the components' changing states. There is one sequence diagram for each use case and use case alternative. The paths taken in the sequence diagrams are traced to steps in the use cases associated to them. The names of the messages between components and the states are implicitly traced to the state diagrams by using the same names for signals and states. The diagrams can be found in the logical view of the model in the Common package under the capsule named Sequence Diagrams.

Finally, the structure and state diagrams can be found in the logical view of the model. The diagrams are organized into packages according to the major components of the system. States and transitions from the state diagrams and ports and contained capsules from the structure diagrams contain further documentation.

1.3 DEFINITIONS AND TERMINOLOGY

Term	Definition
Active player	A player that is still participating in the game. That is, he has not folded, left the game, or been kicked out.
Bet	A bet is the amount a player adds to the pot on a particular turn. It does not represent the total amount that a player has contributed to the current pot.
Big blind	The player to the left of the small blind is forced to make an opening bet of a predetermined amount before any cards are dealt. This amount is usually larger than the small blind's bet.
Button	A marker that represents who the current dealer is in a game.
Call	A player bets the amount of the current bet minus the amount he has already contributed to the pot in the current round of betting.
Check	The player responsible for making the opening bet passes this responsibility to the next player.
Communal Card	A card that all players can use in their hand. Communal cards are dealt face up for all to see.
Current bet	The value of the current bet is the sum of the opening bet plus all of the raises in a round.
EPS	Electronic poker system. This is the electronic version of Texas Hold'em Poker, which includes all software.
EPSS	The electronic poker system server that runs the EPS (thus administrating all poker games in the casino).
Flop	The first three communal cards that are dealt.

Term	Definition
Fold	A player drops out of a poker game. He no longer participates in betting rounds and relinquishes his stake in the pot.
Flush	A poker hand composed of five cards of the same suit in no particular order. If there is more than one flush, the winning hand is determined by the rank order of the highest card or cards in the flush.
Four of a Kind	A poker hand composed of four cards of the same rank and one unrelated card. One four of a kind poker hand has a higher value than another when the rank of its four equally ranked cards is higher.
Full House	A poker hand composed of three cards of one rank and a pair of another. The rank of the full house is determined by the three card grouping, not the pair. For example a hand of A-A-A-2-2 beats a hand of K-K-K-Q-Q.
Game	A game begins when a new pot is started and the cards are first dealt and ends when the pot is won.
Game Queue	The queue that players wait in to join the table after they have logged into the EPS.
Going All-in	Betting all of the chips that a player has. This may or may not cover the current betting amount.
Hand	The combination of a player's two cards and the currently dealt communal cards.
HHD	A player's hand held device. The graphical representation of this may be referred to as "player interface."
HHD Client	The software for the hand held device.
HHD Queue Server	(See "Game Queue")
No pair	A poker hand composed of five unrelated cards. When no player has a pair, the player with the highest ranked card wins. If two players have the same high card, the player with the next highest card wins. This continues for all five cards.

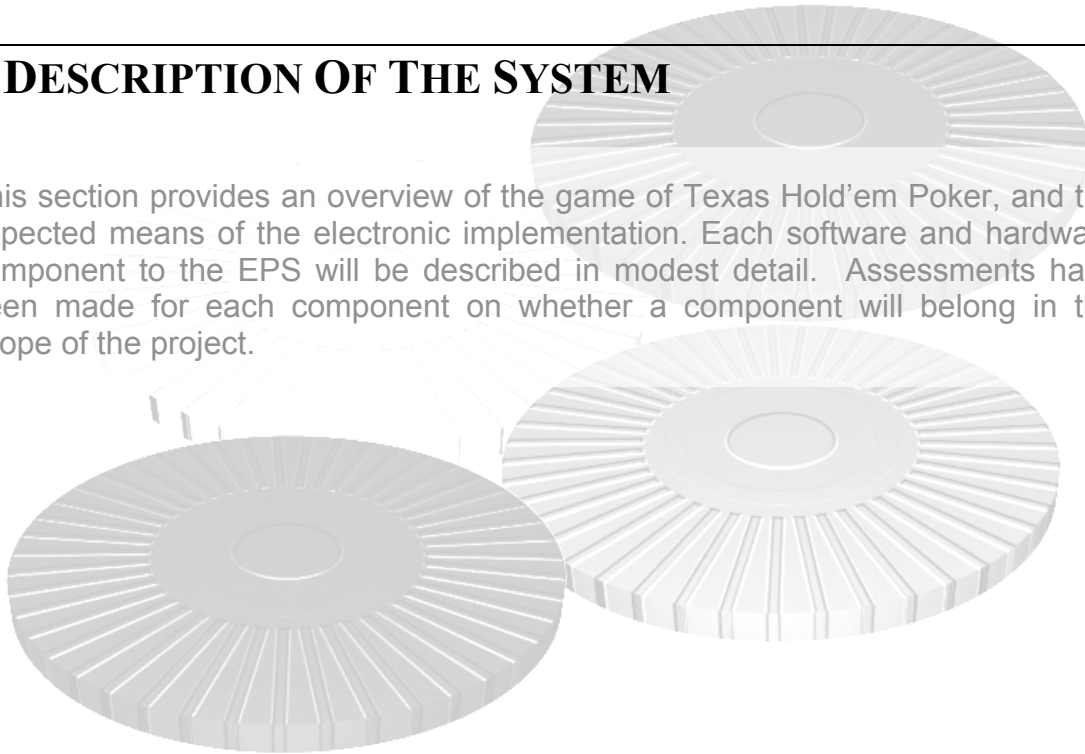
Term	Definition
One Pair	A poker hand consisting of two cards of one rank along with three unrelated cards. If two players hold the same pair, the value of the unrelated side cards determines the winner.
Opening bet	The first bet made in a round of betting.
Player	The user of the system that interacts with the handheld devices and plays Texas Hold'em Poker.
Poker	Texas Hold'em Poker.
Poker Hand	A five card hand consisting of any combination of a player's private cards and the communal cards.
Poker Hand Valuation Rules	<ul style="list-style-type: none"> - Each suit is equal in value. - Of the thirteen ranks in each suit, the Ace is the highest ranking card followed by King, Queen, Jack and ten through two. - An Ace may also be used as the lowest ranking card in a five-high straight (5-4-3-2-Ace). - Values of hands are graded in the following order from highest to lowest: <ul style="list-style-type: none"> o Royal Flush / Straight Flush o Four of a Kind o Full House o Flush o Straight o Three of a Kind o Two Pairs o One Pair o No Pairs - If more than one player has the same hand value, the winner is determined by the tie rules of that specific hand value.
Pot	The total amount of money that has been bet in a poker game by all players.
Raise	A player calls the current bet and then increases it by a raise amount.

Term	Definition
River	The fifth and final communal card that is dealt.
Royal Flush	An Ace high straight flush.
Session	The time a user is logged into the system, including time spent in the queue, is called a session.
Side Pot	All chips in the pot that are not available to be won by the player who went all-in.
Small blind	The player to the left of the dealer who is forced to make an opening bet of a predetermined amount before any cards are dealt.
Standard Deck	A standard deck consists of fifty-two cards with no jokers. There are four suits (spades, hearts, diamonds and clubs) and thirteen ranks in each suit (Ace, King, Queen, Jack and ten through two).
Straight	A poker hand consisting of five sequenced cards, not all of the same suit. If more than one straight is present, the highest card in the sequence determines the winning hand.
Straight Flush	A poker hand consisting of five cards of the same suit in sequence. One straight flush poker hand has a higher value than another when its high card has a higher rank.
SVC	System Visualization Component. This is a view that shows all of the current information of the poker table. Only the administrator has access to this view. The graphical representation of this may also be referred to as "administrator interface."
Table	A placeholder for players where they play numerous games.
Three of a Kind	A poker hand consisting of three cards of the same rank along with two unrelated cards. One three of a kind poker hand has a higher value than another when the rank of its three equally ranked cards is higher.

Term	Definition
Turn	The fourth communal card that is dealt.
Two Pair	A poker hand consisting of two cards of one rank along with two cards of another rank and a fifth unrelated card. The higher rank of a pair determines the winning hand. If two players hold two pair and each has the same higher ranked pair, then the rank of the second pair determines the winner. If both players hold the same 2 pair, the rank of the unrelated card determines the winning poker hand.
HHD Client	The software for the handheld device.
EPSS	The electronic poker system server that runs the EPS (thus administrating all poker games in the casino).
HHD Queue Server	The queue that players wait in to join the table after they have logged into the EPS.
Game Queue	The queue that players wait in to join the table after they have logged into the EPS.

02 DESCRIPTION OF THE SYSTEM

This section provides an overview of the game of Texas Hold'em Poker, and the expected means of the electronic implementation. Each software and hardware component to the EPS will be described in modest detail. Assessments have been made for each component on whether a component will belong in the scope of the project.



2.1 DESCRIPTION OF THE SYSTEM

When a player wishes to play Texas Hold'em Poker, the player selects an empty handheld device. If there are no handheld devices available the player is placed into a first come first served queue. Once a handheld device becomes free the player at the front of the queue is assigned the empty handheld device. Once a player has been assigned a handheld device, the player enters his/her name and banking information into the device. Upon successful validation of the player's banking information the player becomes part of the game. If there is an active round in progress the player can watch the active round, but cannot play until that round has completed. Players may leave the game at any time. If a player does not have any money at the beginning of a round, they are removed from the game so that players waiting in the queue are allowed a chance to play.

Texas Hold'em Poker is the most popular game played in casino poker rooms. Although playing expertly requires a great deal of skill, Texas Hold'em is easily learned and deceptively simple. It is a subtle and complex game, typically played with up to seven players. Texas Hold'em is also the fastest growing poker game in the world, and it is the game used to determine the world champion at the World Series of Poker.

A round begins with the player to the left of the dealer making a blind bet. This player is said to be in the small blind. In the context of this case study the small blind will always have a value of five dollars. Next, the player to the left of the small blind also makes a blind bet. This player is said to be in the big blind. The big blind will always have a value of ten dollars. Once the blind bets have been made, two cards are dealt face down to each player, and a round of betting takes place. The first round of betting starts with the player to the left of the big blind. Each player may either call or raise the big blind bet, or fold their hand. There is no maximum of the number of raises that are allowed per round. A bet may be raised by any multiple of ten dollars. For example, a raise of one-hundred dollars is a valid raise; however a raise of eighty-three dollars is not. When the first round of betting is complete, three communal cards, called the flop, are turned face up in the center of the table. Once the three community cards have been dealt, there is another round of betting. On this and each succeeding round of betting, the player to the left of the dealer begins. The dealer is the last to bet. Players may check or raise if no one has bet when it is their turn to act. If there is a bet, players may fold, call, raise, or reraise. Once the second round of betting has been completed, a fourth communal card, called the turn, is then exposed. Another round of betting takes place. Then the fifth and final community card, known as the river, is placed in the center of the table followed

by the last round of betting. The best five-card poker hand using any combination of a player's two private cards and the five communal cards is the winner. The winner receives all the money that has been bet by the other players, called the pot. Once a round has been completed, the dealer moves to the left, and the cards are re-shuffled.

2.2 SCOPING

This portion outlines each software and hardware component to the EPS. Each component assessed as “in scope” or “out of scope”. Any requirement that is deemed “out of scope” is expected to be fulfilled by Juan Pablo Enterprises. Failure to do so will result in the inoperability of the EPS.

2.2a NOTATIONS

Scoping identifiers use the following notation:

SC-XX-YY

All scoping identifiers start with the prefix *SC*. The “XX” block is any two alpha characters which represent the group that the scope statement belongs to. The “YY” is a two numeric character block which is used to uniquely identify a scoping element.

2.2b COMPONENTS OUT OF SCOPE

HARDWARE COMPONENTS

Identifier	Scoping Element	
SC-OH-01	x86 computer server	Quantity 3
	The x86 computer servers will execute the software instructions defined in the EPS. The acquisition, installation or maintenance of each x86 computer server is out of scope of the EPS.	
SC-OH-02	Handheld Devices	Quantity Indefinite
	Handheld devices act as a physical terminal for users of the EPS. Each HHD must contain a magnetic stripe reader, capable of deciphering the magnetically embedded data on banking cards and credit cards. In addition, each HHD must be compliant with the IEEE 802.11g standard. It is the responsibility of Juan Pablo Enterprises to assess the desired quantity of HHD units. The acquisition, installation or maintenance of each HHD is out of scope of the EPS.	

HARDWARE COMPONENTS

Identifier	Scoping Element	
SC-OH-03	Wireless Access Points	Quantity Indefinite
	<p>Wireless access points provide a means of communication between each HHD and the x86 computer servers. It is the responsibility of Juan Pablo Enterprises to assess the desired quantity of wireless access points. The acquisition, installation or maintenance of each wireless access point is out of scope of the EPS.</p>	
SC-OH-04	Uninterruptible Power Supply	Quantity 1
	<p>The UPS allows disaster recovery during a “power failure” scenario. The UPS will service all x86 computer servers and all wireless access points. The acquisition, installation or maintenance of the UPS is out of scope of the EPS.</p>	
SC-OH-05	Secure Line to Central Banking System	Quantity 1
	<p>A secure line to the CBS will be used by the Transaction Server to mediate all financial transactions for the EPS. The acquisition, installation or maintenance for the secure line is out of scope of the EPS.</p>	
SC-OH-06	Internal Network	Quantity 1
	<p>An internal network will provide a means of communication between the software components of the EPS. Juan Pablo Enterprises must ensure all x86 computer servers, handheld devices and wireless access points participates on a single internal network. The acquisition, installation or maintenance of the internal network is out of scope of the EPS.</p> <p>The software service that will administrate the internal network must be provided by the Windows family of software. TeamGERM is not responsible for the maintenance or failure of this hardware, or network services provided by the Windows family of software.</p>	

SOFTWARE COMPONENTS		
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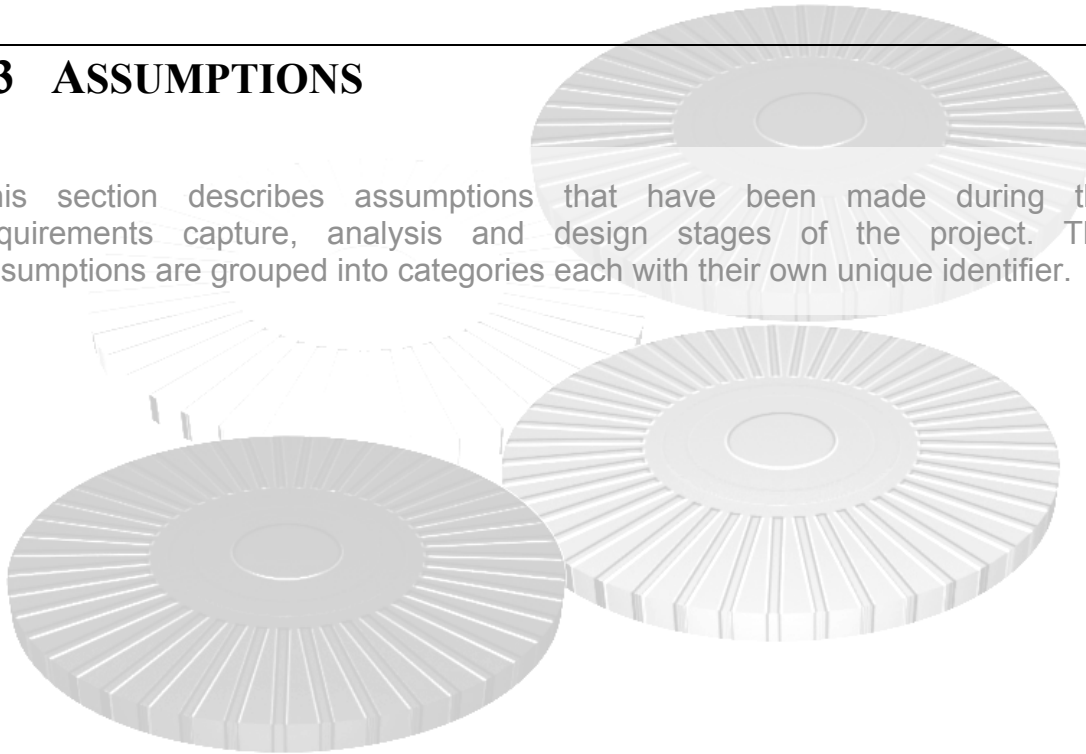
Identifier	Scoping Element	
SC-OS-01	Central Banking System	Quantity 1
	The CBS software service must be used to process all financial transactions to the appropriate institutions for the EPS. Development of the CBS is out of scope for the EPS.	
SC-OS-02	Windows 2003 Server	Quantity 3
	The EPS is dependent on the operating system facilities provided by Windows 2003 Server. Each x86 computer server must contain an installation of Windows 2003 Server. The acquisition of Windows 2003 software licenses is out of scope of the system. In addition, TeamGERM is not responsible for the maintenance or failure of the software services provided by the Windows family of software.	
SC-OS-03	Windows Embedded	Quantity Indefinite
	The EPS is dependent on the operating system facilities provided by Windows Embedded. Each HHD must contain an installation of Windows Embedded. The acquisition of Windows Embedded software licenses is out of scope of the system. In addition, TeamGERM is not responsible for the maintenance or failure of the software services provided by the Windows family of software.	

2.2c COMPONENTS IN SCOPE

SOFTWARE COMPONENTS		
Identifier	Scoping Element	
SC-IS-01	Electronic Poker System Server	Quantity 1
	The EPSS administrates games of “Texas Hold’em” style poker. Development of the EPSS software is in the scope of the system. One license will be granted to Juan Pablo Enterprises.	
SC-IS-01	Handheld Device Queue Server	Quantity 1
	The HHD Queue Server will assist users of the EPS to participate in the next available game on the EPSS. Development of the HHD Queue Server is in the scope of the system. One license will be granted to Juan Pablo Enterprises.	
SC-IS-03	Transaction Server	Quantity 1
	The Transaction Server will mediate all financial transactions for the EPS to the CBS. One license will be granted to Juan Pablo Enterprises.	
SC-IS-04	Handheld Device Client	Quantity 1
	The HHD Client will allow a player to engage in a session with the EPS. The HDD Client will translate the choices a player makes during a session to the EPSS. Development of the HHD Client is in the scope of the system. Although TeamGERM is only obligated to include one hardcopy of the HHD Client; an unlimited license for the HHD Client will be granted to Juan Pablo Enterprises, allowing the HHD Client to be installed on an indefinite amount of Handheld Devices.	

03 ASSUMPTIONS

This section describes assumptions that have been made during the requirements capture, analysis and design stages of the project. The assumptions are grouped into categories each with their own unique identifier.



3.1 NOTATIONS

Assumption identifiers use the following notation:

ASS-XXX-YYY

All assumption identifiers start with the prefix `ASS`. The “`XXX`” block is any three alpha characters which represent the group that the assumption belongs to. The “`YYY`” is a three numeric character block which is used to uniquely identify an assumption.

3.2 ASSUMPTIONS

HANDHELD DEVICES

Identifier	Assumption	Justification
ASS-HHD-001	We will assume there is an unlimited number of HHDs.	The scope of the project does not extend to dealing with players who are not able to acquire an HHD. Team Development Day (Feb 5)
ASS-HHD-002	HHDs are always turned on.	There is no requirement mentioning on and off functionality for the HHDs. Team Development Day (Feb 5)
ASS-HHD-003	The HHDs can display any resolution.	This was mentioned by TA Dave on the message board. <i>(General: Handheld Device)</i> Team Discussion Board (Jan 31)
ASS-HHD-004	The HHDs have a keyboard or keypad.	This was mentioned by TA Dave on the message board. <i>(General: Handheld Device)</i> Team Discussion Board (Jan 31)

GENERAL POKER RULES

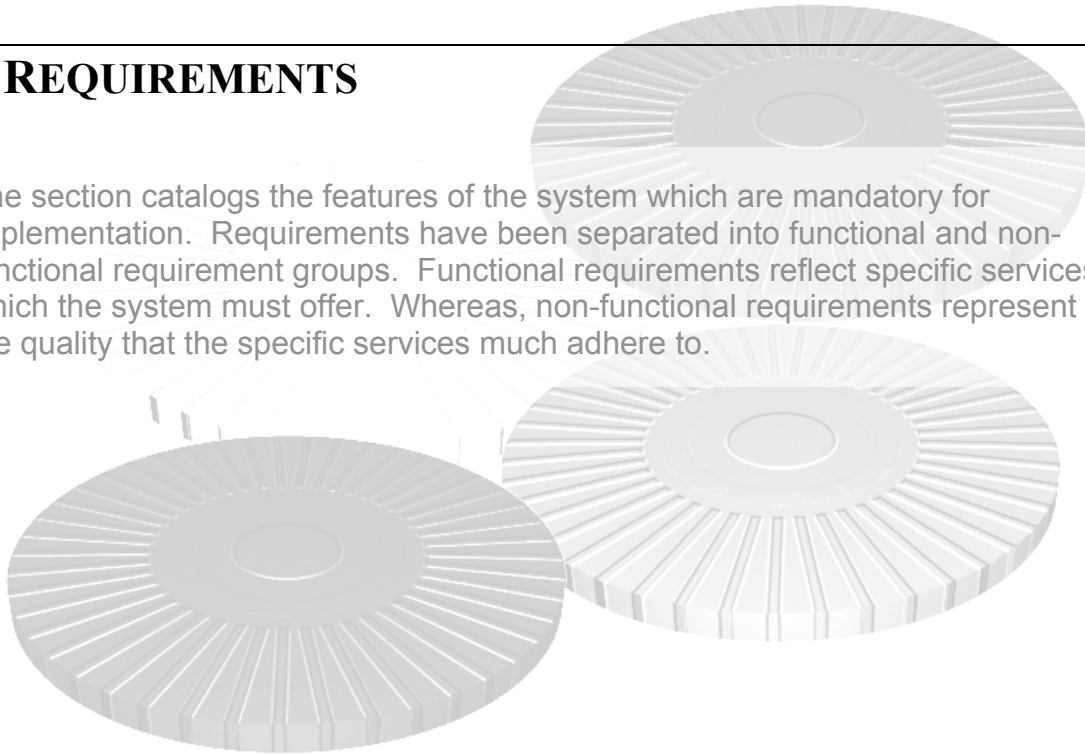
Identifier	Assumption	Justification
ASS-GPR-001	Only one game of poker can be played at a table at a time.	This conforms to standard casino poker table rules. Team Development Day (Feb 5)
ASS-GPR-002	After the last round of betting, the hands of all players who did not fold are revealed to everyone.	This conforms to the standard rules of Texas Hold'em. Team Development Day (Feb 5)
ASS-GPR-003	Cards are dealt from the top of the deck.	This is the simplest way to deal cards and also conforms to the standard rules of Texas Hold'em. Team Development Day (Feb 5)
ASS-GPR-004	When a bet is made, the value of said bet is added to the pot.	This conforms to the standard rules of Texas Hold'em. Team Development Day (Feb 5)
ASS-GPR-005	If every player in a betting round checks, then the betting round is closed with no bets made.	This conforms to the standard rules of Texas Hold'em. Team Development Day (Feb 5)
ASS-GPR-006	If a player goes all in, he may not bet for the rest of the game.	This conforms to the standard rules of Texas Hold'em. Team Development Day (Feb 5)
ASS-GPR-007	A new poker game will start when the previous poker game ends.	The scope of the system does not define any activity that takes place at the poker table aside from playing poker games. This suggests that games should be played continuously at the table. Team Meeting (Feb 8)

GENERAL ASSUMPTIONS

Identifier	Assumption	Justification
ASS-GA-001	The game queue has unlimited space and cannot be filled.	The scope of the project is limited to players at the table or in the game queue. (See ASS-GA-002). Team Discussion Board (Feb 10)
ASS-GA-002	If the player cannot get his banking information from the CBS, he will not be able to log in.	If the player cannot make a withdrawal from the bank he will not be able to purchase chips. He will not have chips from previous sessions because all chips are cashed in when the player logs out. A player cannot sit at the poker table unless he has chips. Therefore there is no purpose for a player to be logged in if he has not obtained his banking information. Team Discussion Board (Feb 10)

04 REQUIREMENTS

The section catalogs the features of the system which are mandatory for implementation. Requirements have been separated into functional and non-functional requirement groups. Functional requirements reflect specific services which the system must offer. Whereas, non-functional requirements represent the quality that the specific services must adhere to.



4.1 NOTATIONS

The requirements section is separated into functional and non-functional requirements. The functional requirements use codes that begin with `RF-` and the non-functional requirements have codes that begin with `RNF-`.

Functional requirements are further subdivided into major and minor categories to make finding particular requirements easier. The major categories are given their own tables. The minor categories are listed with bold and italicized headings in the table. The various minor categories have different codes and always start at `001`. Following is a list of the categories:

Category	Notation
Player Interaction	RF-PI
Joining a Game	RF-JG
Playing a Game	RF-PG
Poker Rules	
Betting Rules	RF-BR
Game Rules	RF-GR
Hand Valuation	RF-HV
Visualization	RF-PI
Hand Held Device	RF-HH
System Visualization Component	RF-SV
Central Banking System	RF-CB

Any gaps in the numbering are a direct result of changing requirements. Rather than changing all subsequent numbers and updating each reference made to these requirements, we leave all untouched requirements alone.

Traceability codes are used to reference any literature from which each requirement has been derived. The traceability codes are as follows:

Traceability Description	Notation
Case Study document supplied by Juan Pablo on the course web page.	REQ-DOC
Case Study Addendum supplied by Juan Pablo on the course web page.	REQ-ADD
MSN Discussion Group monitored by course teacher assistant.	REQ-WEB

In the case of REQ-DOC and REQ-ADD, the page, section, paragraph and sentence numbers will be listed in that order (e.g. PAGE-SECTION-PARAGRAPH-SENTENCE).

4.2 NON FUNCTIONAL REQUIREMENTS

Identifier	Description	Traceability
RNF-002	The user interface must be user friendly and easy to learn.	REQ-WEB

4.3 FUNCTIONAL REQUIREMENTS

PLAYER INTERACTION

Identifier	Description	Traceability
RF-PI-001	The EPS must support up to seven concurrent players.	REQ-DOC 1-1.1-2-2
RF-PI-002	A single player at a table must wait for at least a second player before a game can begin.	REQ-DOC 3-1.3.3-1-2
RF-PI-003	Each player will interact with the EPS using a dedicated HHD.	REQ-DOC 1-1.1-2-3
RF-PI-004	When a player wishes to play poker, he will pick up an idle HHD.	REQ-DOC 1-1.2-1-2
RF-PI-005	A player can end his session with the EPS at any time.	REQ-DOC 1-1.2-2-4
<i>Joining A Game</i>		
RF-JG-001	A player logs into the EPS after he is assigned an HHD.	REQ-DOC 1-1.2-2-1
RF-JG-002	The system must co-ordinate with the CBS to validate the user's banking information.	REQ-DOC 7-1.4-1-2
RF-JG-003	A player's banking information must be validated by ensuring that he has at least \$20 in his account and that his account number is valid.	REQ-WEB
RF-JG-004	The system must place the player into the game queue upon successful login.	REQ-WEB
RF-JG-005	While in the game queue, players must be able to watch active rounds.	REQ-DOC 1-1.2-2-3
RF-JG-006	The next player in the queue will join the table when there is a place available and a game ends.	REQ-DOC 1-1.2-2-1

Identifier	Description	Traceability
RF-JG-007	A player must enter his banking information and name to begin a session with the EPS.	REQ-DOC 1-1.2-2-1
<i>Playing A Game</i>		
RF-PG-001	A player must be able to leave the table at any time.	REQ-DOC 1-1.2-2-4
RF-PG-002	A player's chips must be automatically cashed into his account with the CBS when he leaves the table.	REQ-DOC 7-1.4-3-1
RF-PG-003	A player with no chips left at the beginning of a game must be forced to leave the system.	REQ-DOC 1-1.2-2-5
RF-PG-004	Fellow players do not know that a player has left the game until that player's turn has been reached.	REQ-WEB

POKER RULES

Identifier	Description	Traceability
<i>Betting Rules</i>		
RF-BR-001	At the beginning of a game, the small blind is forced to make a bet of five dollars.	REQ-DOC 2-1.3.1-1-3
RF-BR-002	The big blind is forced to make a bet of ten dollars.	REQ-DOC 2-1.3.1-1-6
RF-BR-003	Every betting round requires a check or an opening bet from the first player to act.	REQ-DOC 7-1.3.1-4-3
RF-BR-004	An active player must be able to check on his turn during a round of betting when no opening bet has been made.	REQ-DOC 7-1.3.1-4-3
RF-BR-005	An active player must be able to call the current bet on his turn during a round of betting.	REQ-DOC 7-1.3.1-4-4
RF-BR-006	An active player must be able to raise the current bet on his turn during a round of betting.	REQ-DOC 7-1.3.1-4-4
RF-BR-007	Every bet except for the small blind's bet must be a multiple of \$10.	REQ-DOC 7-1.3.1-2-5
RF-BR-008	A player must not be able to bet more than the value of the chips he has.	REQ-DOC 6-1.3.8.1-1-4
RF-BR-009	An active player must be able to fold on his turn during a round of betting after an opening bet has been made.	REQ-DOC 6-1.3.8-2-4
RF-BR-010	If a player calls the current bet, but he does not have enough chips to cover the required bet amount, he must go all-in.	REQ-DOC 7-1.3.8.7-1-1

Identifier	Description	Traceability
RF-BR-011	If a player is all-in, he must only be able to win from each other player the amount that he has actually bet.	REQ-DOC 7- 1.3.8.7- 1-4
RF-BR-012	If the player who went all in wins the game, the side pot goes to the active player with the next highest poker hand value.	REQ-DOC 7-1.3.1- 1-3
RF-BR-013	A player has a maximum of 15 seconds to act on his turn in a betting round.	REQ-DOC 3-1.3.3- 2-1
RF-BR-014	A player that does not act on two turns in a row must be removed from the table.	REQ-DOC 3-1.3.3- 2-3
RF-BR-014	If a player does not act on his turn, he must automatically fold.	REQ-DOC 3-1.3.3- 2-2
<i>Game Rules</i>		
RF-GR-001	Each game must use a freshly shuffled standard deck.	REQ-DOC 3-1.3.5- 1-3
RF-GR-002	A tester of the EPS must have the ability to specify which card(s) in the deck will be dealt next.	REQ-WEB
RF-GR-003	Two cards must be dealt to each player after the blind bets are made.	REQ-DOC 2-1.3.1- 2-1
RF-GR-004	A round of betting must occur after cards are dealt to each of the players or the communal cards are dealt	REQ-DOC 2-1.3.1- 3-2
RF-GR-005	The first round of betting must begin with the player to the left of the big blind.	REQ-DOC 2-1.3.1- 2-2
RF-GR-006	Every round of betting after the first will begin with the first active player to the left of the dealer.	REQ-DOC 2-1.3.1- 4-1

Identifier	Description	Traceability
RF-GR-007	A round of betting must end when all active players have called the current bet:	REQ-DOC 2-1.3.1- 2-3
RF-GR-008	In the first round of betting of a game, if no one raises the big blind bet, the big blind has an opportunity to raise his own big blind bet.	REQ-DOC 6- 1.3.8.2- 2-1
RF-GR-009	After the first round of betting, the flop must be dealt face up.	REQ-DOC 2-1.3.1- 3-1

Identifier	Description	Traceability
RF-GR-010	After the second round of betting, the turn must be dealt face up.	REQ-DOC 2-1.3.1-5-1
RF-GR-011	After the third round of betting, the river must be dealt face up.	REQ-DOC 2-1.3.1-5-3
RF-GR-012	After the last round of betting, hands must be evaluated and a winner must be determined.	REQ-DOC 2-1.3.1-5-4
RF-GR-013	The winner of a game must receive all of the money in the pot.	REQ-DOC 2-1.3.1-5-5
RF-GR-014	After a game is completed, the button must move one position to the left.	REQ-DOC 2-1.3.1-5-6
RF-GR-015	After a game is completed, the cards must be reshuffled.	REQ-DOC 2-1.3.1-5-6
RF-GR-016	The feature to specify the cards dealt next must have the ability to be turned on and off.	REQ-WEB
RF-GR-017	Players must not be able to see each other's cards.	REQ-DOC 2-1.3.1-2-1
<i>Hand Valuation</i>		
RF-HV-001	The winner must be determined as the active player with the highest valued poker hand.	REQ-DOC 6-1.3.8-3-2
RF-HV-002	A poker hand must be valuated with the poker hand valuation rules.	REQ-DOC 2-1.3.1-5-4

VISUALIZATION

Identifier	Description	Traceability
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Hand Held Device

RF-HH-001	A player's table position must be represented on his HHD as well as the positions of other players.	REQ-DOC 3-1.3.3-1-3
RF-HH-002	A player's table position must be absolute and must not change during or in between rounds.	REQ-DOC 3-1.3.3-1-4
RF-HH-003	The button must be represented on the HHD to notify all players of who the dealer is.	REQ-DOC 8-2.1.2-1-1
RF-HH-004	Chips must be used to represent bets made by players.	REQ-DOC 3-1.3.6-1-1
RF-HH-005	The colors of chips must be defined as follows: White - \$5 Red - \$10 Green - \$50 Black - \$100 Purple - \$500	REQ-DOC 3-1.3.6-1-2
RF-HH-007	The HHD must have a numeric keypad to enter account PIN numbers when using debit cards.	REQ-DOC 7-1.4-2-1
RF-HH-008	The player's banking information must be displayed on his HHD.	REQ-DOC 8-2.1.2-1-1
RF-HH-009	The player's cards must be displayed face up on his HHD.	REQ-DOC 8-2.1.2-1-1
RF-HH-010	All other players' cards must be displayed face down on a player's HHD.	REQ-DOC 8-2.1.2-1-1
RF-HH-011	All communal cards must be displayed face up on a player's HHD.	REQ-DOC 8-2.1.2-1-1

Identifier	Description	Traceability
RF-HH-012	The pot for the current poker game must be displayed on a player's HHD.	REQ-DOC 8-2.1.2-1-1
RF-HH-013	Every player's bets must be displayed on a player's HHD.	REQ-DOC 8-2.1.2-1-1
RF-HH-014	The amount of chips each player has left must be displayed on a player's HHD.	REQ-DOC 8-2.1.2-1-2
RF-HH-015	Each HHD must contain a chat window.	REQ-ADD 1-1.2-2-1
RF-HH-016	The chat window on each HHD must consist of a message sending part where the user will be able to type a message.	REQ-ADD 1-1.2-2-2
RF-HH-017	The chat window on each HHD must consist of a list of all received messages.	REQ-ADD 1-1.2-2-2
RF-HH-018	A chat message must be broadcast to all players sitting at the table when a message is sent, regardless of their status.	REQ-ADD 1-1.2-2-4
RF-HH-019	Messages sent from the chat window must contain the name of the player who sent the message, the time the message was sent, and the message text.	REQ-ADD 1-1.2-3-2

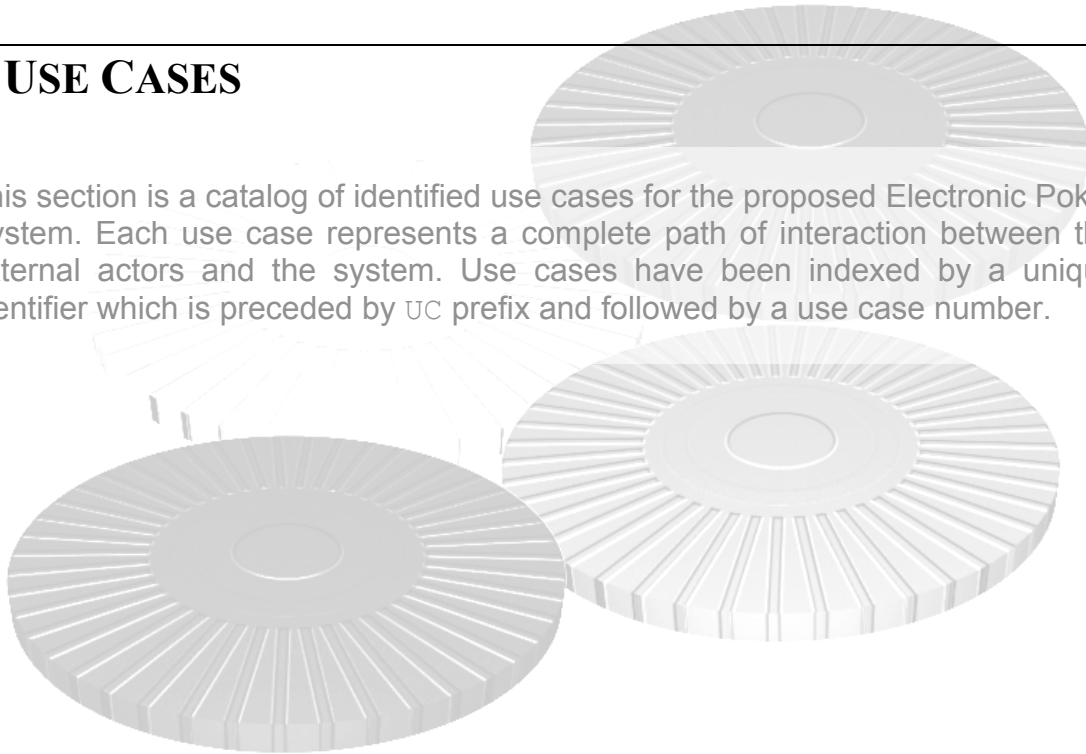
Identifier	Description	Traceability
<i>System Visualization Component</i>		
RF-SV-001	The SVC must display the table position of each player.	REQ-DOC 8-2.1.1-1-1
RF-SV-002	The SVC must display each player's cards face up.	REQ-DOC 8-2.1.1-1-3
RF-SV-003	The SVC must display all communal cards face up.	REQ-DOC 8-2.1.1-1-3
RF-SV-004	The SVC must display the pot of the current poker game.	REQ-DOC 8-2.1.1-1-4
RF-SV-005	The SVC must display how much money each player at the poker table has left.	REQ-DOC 8-2.1.1-1-4
RF-SV-006	There must be a log in for an administrator who can see the SVC.	REQ-WEB
RF-SV-007	All steps involved when starting the EPS must be considered.	REQ-WEB
RF-SV-008	The SVC must provide a way to turn the EPS on and off.	REQ-WEB

CENTRAL BANKING SYSTEM

Identifier	Description	Traceability
RF-CB-002	All financial transactions must take place within the CBS.	REQ-DOC 7-1.4-1-1
RF-CB-003	A player must be able to use a debit or credit card to access their account in the CBS.	REQ-DOC 7-1.4-2-2
RF-CB-004	A player must enter a valid PIN when using his debit card for a transaction.	REQ-DOC 7-1.4-2-3
RF-CB-005	All withdrawal transactions with the CBS must be in multiples of \$10.	REQ-DOC 7-1.4-2-5
RF-CB-006	A player must only be able to make withdrawals to buy chips.	REQ-WEB
RF-CB-007	A player must only be able to make deposits to cash in chips.	REQ-WEB
RF-CB-008	The system must handle errors from the CBS.	REQ-WEB
RF-CB-009	A player must be able to change his account information at any time.	REQ-WEB
RF-CB-010	A player must be able to purchase poker chips at any time.	REQ-WEB
RF-CB-011	A player must withdraw at least \$20 on his first transaction.	REQ-WEB

05 USE CASES

This section is a catalog of identified use cases for the proposed Electronic Poker System. Each use case represents a complete path of interaction between the external actors and the system. Use cases have been indexed by a unique identifier which is preceded by UC prefix and followed by a use case number.



5.1 USE CASE LIST

The following table is a list of use cases which appear in this section: On the next page, a template describing the use case textual descriptions is presented.

Identifier	Use Case Title
UC-001	Administrator Turns On System
UC-002	Administrator Shuts Down System
UC-003	Tester Cheats by Rigging the Deck
UC-004	Player Logs In to the System
UC-005	Player Enters Banking Information
UC-006	Player Logs Out of the System
UC-007	Player Joins the Poker Table
UC-008	Player Purchases Poker Chips
UC-009	Player Goes All-In
UC-010	Playing a Poker Game
UC-011	Round of Betting
UC-012	Player Chats

5.2 SAMPLE USE CASE

UC-###	Use Case Name	Traceability
Description:	A short textual description of the use case.	
External Actors:	A list of the actors involved.	
Related Use Cases:	UC-### - Related Use Case	
Preconditions:	Conditions that must be true before a use case can begin.	
Triggering Events:	The event which starts the use case.	
1)	Steps taken in use case.	
2)		
Resulting Event:	The event that results in the successful completion of the use case.	
Postcondition:	Conditions that will be true on successful completion of the use case.	
Alternatives:	UC-###-ALT-01 Alternative 1 Steps UC-###-ALT-02 Alternative 2 Steps	
Non-functional Requirements:	A description of the non-functional requirements satisfied by this use case.	
Comments:	Any additional comments.	

5.3 USE CASES

UC-001	Administrator Turns On System	Traceability
Description:	This is the case where the administrator of the system logs in and starts the system so users can have access.	
External Actors:	- Administrator	
Related Use Cases:		
Preconditions:	The system is turned off.	
Triggering Events:	The administrator chooses to start the system.	RF-SV-008
1)	The administrator boots up any necessary hardware.	RF-SV-007
2)	The administrator runs the appropriate admin interface.	RF-SV-006
3)	The administrator logs in with a unique password.	RF-SV-006
4)	The administrator turns the system on with this interface.	RF-SV-008
5)	The system randomly marks the first seat players will begin filling. This is where the button will be for the first game.	RF-SV-007
Resulting Event:	The system informs the player interfaces that players can log in.	RF-SV-007
Postcondition:	The poker table is idle, players can log in.	
Alternatives:		
Non-functional Requirements:		
Comments:		

UC-002	Administrator Shuts Down System	Traceability
Description:	This is the case where the administrator of the system logs out and turns off the system.	
External Actors:	- Administrator - Player	
Related Use Cases:	UC-006 Player Logs Out of the System	
Preconditions:	The system is on and running.	
Triggering Events:	The administrator uses the admin interface to shut down the system.	RF-SV-008
1)	The system indicates to the player interfaces that it will be turned off at the end of the current game.	RF-SV-009
2)	All of the players are logged off of the system.	RF-SV-009
3)	The administrator closes the program.	RF-SV-008
4)	The administrator shuts down any necessary hardware	RF-SV-008
Resulting Event:	The system hardware powers down.	RF-SV-009
Postcondition:	The hardware is off and no one is logged into the system.	
Alternatives:		
Non-functional Requirements:		
Comments:		

UC-003	Tester Cheats by Rigging the Deck	Traceability
Description:	Describes how a tester of the system can specify which cards will be dealt during a poker hand.	
External Actors:	- Tester	
Related Use Cases:	UC-010 Playing a Poker Game	
Preconditions:	The testing option that allows for rigged decks is on. A poker game is in progress and at the point where cards can be dealt.	
Triggering Events:	A tester interrupts the poker game to rig the deck before cards are dealt.	RF-GR-002
<ol style="list-style-type: none"> <li data-bbox="451 926 487 961">1) <li data-bbox="451 1056 487 1092">2) <li data-bbox="451 1186 487 1222">3) 	<p>The tester tells the system a sequence of cards that should be dealt instead of the cards from the top of the deck.</p> <p>The specified cards are queued to be dealt in the appropriate sequence by moving to the top of the deck.</p> <p>The cards from the top of the deck are dealt as usual (see UC-010).</p>	<p>RF-GR-002</p> <p>RF-GR-002</p> <p>ASS-GPR-003</p>
Resulting Event:	The next round of betting proceeds.	RF-GR-004
Postcondition:	The appropriate players have the specified rigged cards.	
Alternatives:		
Non-functional Requirements:		
Comments:	<p>A sequence of cards may be of size one.</p> <p>We will only support smart cheating – that is, only cards that have not yet been dealt may be moved to the top of the deck.</p>	

UC-004	Player Logs Into the System	Traceability
Description:	Describes the “Login” process that must be conducted by a player to begin a session with the system.	
External Actors:	- Player	
Related Use Cases:	UC-005 Player Enters Banking Information UC-007 Player Joins the Poker Table	
Preconditions:	Player has access to the player interface.	RF-PI-003 RF-PI-004
Triggering Events:	The system prompts for user name.	RF-JG-001
	<ol style="list-style-type: none"> 1) A player enters name. 2) User enters banking information (execute UC-005). 3) Banking information is verified by the bank system and the account balance is checked for the minimum amount required. 4) Player is entered into the game queue. 	RF-JG-001 RF-JG-001 RF-CB-002 RF-JG-002 RF-JG-003 RF-JG-004
Resulting Event:	System displays active games to the player.	RF-JG-005
Postcondition:	Player is logged into the system.	
Alternatives:	UC-004-ALT-01 If step one or two fails because of a bank error, the player’s session ends.	RF-CB-008
Non-functional Requirements:	Any player has access to only one player interface at a time. He logs in and uses this interface for his entire session.	RNF-001
Comments:		

UC-005	Player Enters Banking Information	Traceability
Description:	Describes the submission and verification of banking information using the player interface.	
External Actors:	- Bank System - Player	
Related Use Cases:	UC-004 Player Logs Into the System	
Preconditions:	Player has access to the player interface and the system is connected to an external bank system.	RF-CB-001
Triggering Events:	Player initiates process for entering or changing banking information.	RF-CB-009
1)	Player selects bank account.	RF-CB-003
2)	System prompts player to swipe card.	RF-CB-003
3)	Player swipes card.	RF-CB-003
4)	Player authenticates choice.	RF-CB-004 RF-HH-007
5)	The bank processes the information.	RF-CB-002 RF-JG-002
6)	The player is notified that the transaction was successful.	RF-HH-008
Resulting Event:	The system changes which account will be used for future transactions.	RF-CB-009
Postcondition:	Money can be withdrawn or deposited from the new account.	

UC-005	Player Enters Banking Information	Traceability
Alternatives:	UC-005-ALT-01 In step five, the bank returns an error. The player gets an error message. The player can either cancel the transaction or return to step one.	RF-CB-008
Non-functional Requirements:		
Comments:	The player can enter his banking information at any time, thus changing the account he is working with.	RF-CB-009

UC-006	Player Logs Out of the System	Traceability
Description:	This is the case in which a player leaves the electronic poker system.	
External Actors:	- Player - Banking System	
Related Use Cases:	UC-004 Player Logs Into the System	
Preconditions:	The player is logged into the system.	
Triggering Events:	The player makes a request to log out of the system while seated at the poker table, or the player may be forced to leave.	RF-PI-005 RF-PG-001 RF-BR-014
<ol style="list-style-type: none"> 1) The player folds in the current poker game when it is his turn. 2) The player's chips are automatically deposited into the player's current account. 3) The player leaves the poker table. 4) The system ends the player's session. 5) The current poker game finishes without the player who left. 		RF-PI-005 RF-PG-004 RF-PG-002 RF-CB-007 RF-PI-005 RF-PI-005 RF-PI-005
Resulting Event:	The poker table informs the game queue that a seat is available for a new player.	RF-JG-006
Postcondition:	The player no longer has a session with the system.	
Alternatives:	UC-006-ALT-01 The player makes the request to leave while in the game queue in step one. Steps two, four, and six are skipped.	RF-PI-005
Non-functional Requirements:		
Comments:		

UC-007	Player Joins the Poker Table	Traceability
Description:	Describes the process of joining the poker table.	
External Actors:	- Player	
Related Use Cases:	UC-004 Player Logs Into the System UC-008 Player Purchases Poker Chips UC-010 Playing a Poker Game	
Preconditions:	The poker table has less than seven players and the player is the next player in the queue.	RF-PI-001
Triggering Events:	A seat is available at the poker table.	RF-JG-006
	<ol style="list-style-type: none"> 1) Player is moved from the queue to the table. 2) Player is assigned an absolutely positioned seat at the poker table. 	RF-JG-006 RF-HH-002 RF-JG-006
Resulting Event:	A poker game begins.	
Postcondition:	Player has a seat at the poker table.	
Alternatives:	UC-007-ALT-01 There are less than two players at the table at the end of step two. The game does not begin.	RF-PI-002
Non-functional Requirements:		
Comments:		

UC-008	Player Purchases Poker Chips	Traceability
Description:	Describes the process a player must conduct to purchase poker chips.	
External Actors:	- Player - Banking System	
Related Use Cases:	UC-004 Player Logs Into the System UC-007 Player Joins the Poker Table UC-010 Playing a Poker Game	
Preconditions:	Player is currently seated at the poker table.	
Triggering Events:	Player initiates the process of withdrawing money to buy poker chips with the player interface.	RF-CB-010
	1) Player enters as a predefined multiple the amount he wishes to withdraw and convert into poker chips.	RF-CB-005 RF-CB-006 RF-CB-011
	2) Money is withdrawn from the current bank account associated with the player.	RF-CB-002
	3) The player's chip count increases by the amount withdrawn from the bank.	RF-CB-006
Resulting Event:	The player's chip count is updated on the player and admin interfaces. His bank information is updated on the player interface.	RF-HH-008 RF-HH-014 RF-SV-005
Postcondition:	The player has more chips available for play than before.	

UC-008	Player Purchases Poker Chips	Traceability
<p>Alternatives:</p>	<p>UC-008-ALT-01</p> <p>The user enters an amount to withdraw in step one.</p> <p>The system informs the player that he has insufficient funds to complete the transaction.</p> <p>He reenters another amount or cancels the transaction altogether.</p>	<p>RF-CB-008</p>
	<p>UC-008-ALT-02</p> <p>The bank system returns an error in step two.</p> <p>The player receives an error message and has the option to try again or cancel the transaction.</p>	<p>RF-CB-008</p>
<p>Non-functional Requirements:</p>		
<p>Comments:</p>	<p>Note that when a player is seated at the poker table, he must have earlier entered valid banking information in order to have logged on. He thus already has a bank account associated with his session.</p> <p>Players can purchase poker chips at any time.</p>	

UC-009	Player Goes All-In	Traceability
Description:	This is the case where a player bets the entire amount of his chips in a poker game.	
External Actors:	- Player	
Related Use Cases:	UC-011 Round of Betting	
Preconditions:	The player is part of the current poker game.	
Triggering Events:	Player does not have the chips to make the his bet.	RF-BR-010
1)	The player places all of his remaining chips into the pot.	RF-BR-010
2)	A side pot is set up with all of the chips that the player's bet will not cover.	RF-BR-011
Resulting Event:	The betting round continues with all of the further bets going into the side pot.	RF-BR-011
Postcondition:	The player is now considered "all-in" and will not make any more bets in the poker game.	
Alternatives:		
Non-functional Requirements:		
Comments:		

UC-010	Playing A Poker Game	Traceability
Description:	This is the case where one game of poker is played to completion. This game will be moderated by the system and be played by the players at the table.	
External Actors:	- Player - Tester	
Related Use Cases:	UC-011 Round of Betting UC-009 Player Goes All-In UC-003 Tester Cheats by Rigging the Deck	
Preconditions:	There are at least two players sitting at the poker table and the table is currently idle (no game being played). The deck of cards is a complete shuffled deck. The pot is empty.	RF-GR-001 RF-GR-015
Triggering Events:	A new game begins.	ASS-GPR-007
1)	System prompts the player to the left of the dealer to post the small blind bet.	RF-BR-001
2)	Player to the left of the dealer posts the small blind bet.	RF-BR-001
3)	System prompts the player to the left of the small blind to post the big blind bet.	RF-BR-002
4)	The player to the left of the small blind posts the big blind bet.	RF-BR-002
5)	System deals two face down to each player currently sitting at the table from the top of the deck of cards.	RF-GR-003
6)	The first round of betting occurs (see UC-011) starting with the player to the left of the big blind.	RF-GR-004 RF-GR-005
7)	System deals flop community cards.	RF-GR-009
8)	A round of betting occurs (see UC-011) starting with the first active player to the left of the dealer.	RF-GR-004 RF-GR-006

UC-010	Playing A Poker Game	Traceability
9)	The turn community card is dealt.	RF-GR-010

UC-010	Playing a Poker Game	Traceability
	<p>10) A round of betting occurs (see UC-011) starting with the first remaining player to the left of the dealer.</p> <p>11) The river community card is dealt.</p>	<p>RF-GR-004 RF-GR-006</p> <p>RF-GR-011</p>
	<p>12) A round of betting occurs (see UC-011) starting with the first active player to the left of the dealer.</p> <p>13) The hands of all of the remaining players are revealed to everyone at the table.</p> <p>14) The player with the highest poker hand value, as per the valuation rules, is the winner.</p> <p>15) The value of the money in the pot is added to the chip value the winner already has.</p>	<p>RF-GR-004 RF-GR-006</p> <p>ASS-GPR-002</p> <p>RF-HV-001 RF-HV-002 RF-GR-012</p> <p>RF-GR-013</p>
Resulting Event:	The system resets the value of the pot to \$0 and moves the button one position to the left. The cards are reshuffled.	RF-GR-014 RF-GR-015
Postcondition:	The table is idle (no games are being played).	
Alternatives:	<p>UC-010-ALT-01</p> <p>In step fifteen, a winner who went “all-in” (see UC-009), collects the money from the original pot and not the side pot.</p> <p>The value of the side pot goes to the remaining active player(s) with the next highest hand value.</p>	<p>RF-BR-011 RF-BR-012</p>
Non-functional Requirements:		
Comments:	The cards may be automatically dealt by the system on behalf of the dealer as opposed to physically dealt by the dealer.	

UC-011	Round of Betting	Traceability
Description:	This is where all of the players remaining in a poker game place bets in an effort to win the pot.	
External Actors:	- Player	
Related Use Cases:	UC-006 Player Logs Out of the System UC-009 Player Goes All-In UC-010 Playing a Poker Game	
Preconditions:	A hand of poker is being played at the poker table.	
Triggering Events:	Cards are dealt either to specific players or as community cards.	RF-GR-004
	1) The first remaining player to the left of the dealer selects an opening bet amount in a predefined multiple.	RF-GR-006 RF-BR-007
	2) The value of the bet amount from the player's chip value is added to the value of the pot.	ASS-GPR-004
	3) The player's current chip value is updated and reflected to him and administrator.	RF-HH-014
	4) Every remaining player that has enough chips and has not gone all-in has a predetermined amount of time to take his turn. (He may call, check, or raise the opening bet, or fold or go all-in (See UC-009)).	RF-BR-004 RF-BR-005 RF-BR-006 RF-BR-009 RF-BR-010
	5) After the last remaining player takes his turn (other than the player that made the opening bet), the round of betting is closed.	RF-GR-007
Resulting Event:	The round of betting is closed and the remaining players continue to play poker (see UC-010)	RF-GR-007

UC-012	Player Chats	Traceability
Description:	This use case describes the process for which a player uses the chat function on the HHD.	
External Actors:	- Player	
Related Use Cases:		
Preconditions:	The player is logged into the system and seated at the table. He may or may not be active.	RF-HH-015
Triggering Events:	The player decides to send a chat message.	RF-HH-015
<ol style="list-style-type: none"> 1) The player types a message into the window provided on his player interface. 2) The player selects to send the message. 3) The system broadcasts the message to all other players, including those in the queue. 4) Other players receive the message text along with sender and time information. 		RF-HH-016 RF-HH-016 RF-HH-018 RF-HH-019
Resulting Event:	The message text and other information is displayed on the other players' interfaces.	RF-HH-017
Postcondition:	The list of messages on the player interfaces is up to date but nothing else has changed.	RF-HH-017
Alternatives:		
Non-functional Requirements:	The chat area will be accessible at any given time, and its use will be intuitively easy.	RNF-002
Comments:		

06 DESIGN DECISIONS

The following section outlines some of the major decisions made by teamGERM with regard to design. Although it is not possible to capture every decision, major or minor, we hope to highlight those that will be of the most interest to Juan Pablo Enterprises in terms of features.

Individual design decisions will be presented in the following format: their identifiers will have notation DD-001, and for each decision, possible alternatives and reasons for the chosen solution will be given.

Decision Description	Identifier
Multiple Tables	DD-001
<p>The original specification for this project requested a single table that players may connect to and play poker at. It was an option to create a system that supports multiple tables.</p> <p>Had we chosen to implement one table, the design of our system would have been significantly simpler. This could have lead to a shorter development time and possibly a system that would be more easily maintained.</p> <p>However, it would be extremely difficult to expand the design later had we not decided to include support for more than one table. Because of this we felt that the extra time and effort required was worth it for Juan Pablo Enterprises. At this point, the system merely needs some GUI changes to accommodate additional tables as well as some further testing.</p>	

Decision Description	Identifier
Separation of Queue and Game	DD-002
<p>Because the system specifications included the requirement of queuing players while the seats at the poker table are all taken, the group was faced with the issue of deciding what part of the system would be responsible for tracking the surplus players.</p> <p>The immediate solution that comes to mind is to assign this responsibility to the same portion of the system that controls the games at the poker table. This would mean that the server hosting the games would be the only point that the HHDs would have to connect to, making it easy to track the connections. It would have made it easier to allow the same kinds of requests to be made by players from both the queue and the table. Finally, this design would have simplified the solution for the issue of showing the current game state at the table to players in the queue since all players would be connected to the portion of the system that contains the state.</p> <p>Unfortunately, this design would have lead to a system of lesser security. By moving the queuing responsibilities into a separate server, we have created a system that will protect Juan Pablo Enterprises from security risks. For instance, if a Denial of Service attack targets the queue server, or the server is flooded, the more important game server will not be affected. The client HHDs only know about how to connect to the queue server and this lack of a direct connection to the game server supports the idea that only the queue server could be affected.</p> <p>The chosen solution also allows us to assign keys generated in the table to players. This again adds extra security since it ensures that the game server is only receiving players from the queue. Thus people won't connect to the game server directly, hence jumping in line or stealing seats.</p>	

Decision Description	Identifier
Not Allowing Chip Purchase in the Queue	DD-003
<p>The requirements requested that players be able to purchase chips at any time. The team was faced with a choice of interpretation to this issue because of the separation of game and queue, discussed in DD-002.</p> <p>Had the queue and game been together on one server, allowing players to purchase chips in the queue would not have been an issue. The process would not have been any different than allowing the players to purchase chips during a game.</p> <p>Since the queue was separated for added security, the team initially decided that it would be best to disallow chip purchase in the queue to ensure that the security was not broken. We originally believed that there was no secure way to complete the transaction (note that the bank is accessible only through the game server – see DD-004). When the project neared completion, there were ideas on how to allow this securely, but our original solution to the problem was deemed suitable enough to keep it.</p> <p>We decided that instead of allowing players to purchase chips in the queue, they would have an opportunity to do so at the table in between games in addition to during games. We added a time gap to allow players to complete any desired banking transactions between the fast paced poker games. This fits with the requirement of kicking players off the table when they don't have any chips at all because players will only be removed if at the beginning of the second game they are seated at the table and still don't have chips (note that if there are enough seats, a player may be seated at the table but not actively participating in the current game).</p>	

Decision Description	Identifier
Access to the Banking System	DD-004
<p>Several options were available regarding the fashion in which our system connected to the external banking system.</p> <p>The first option was to simply have a port connection between the game server and the bank as well as between the queue server and the bank. When transactions were required from either server, calls following the external bank system's protocol would be called directly. This is a highly undesirable solution because it ties our system to one and only one specific bank system.</p> <p>The second option would be to decouple our system from one bank by introducing an adapter that would translate our system's requests into calls specific to whichever bank we happen to be connecting to. This not only allows us to change the banking system we are dealing with, but would make it easy to work with more than one at a time.</p> <p>The question remains, however, on where to put this adapter. For instance, yet another server could host the adapter so that the queue and game server could connect to it separately. This may be desirable because it allows us to limit the types of calls the queue server may make regarding bank transactions (for example, withdrawals – see DD-003) while not limiting the game server. The disadvantage to this solution comes from the fact that another server would have to be maintained for little benefit in terms of actual functionality and perhaps no benefit for security.</p> <p>The team decided on using the adapter pattern, but to keep it inside the game server. In this way we eliminate the extra server and we keep the ability to limit what transactions the queue may make. Since the queue must communicate with the game server anyway, the means to add our own signals relating to bank transactions is trivial, and we can, of course, decide on what signals to use.</p>	

Decision Description	Identifier
Table Mappings	DD-005
<p>Since HHDs are connected to the game server after a seat is available to them at the table, a design problem was to decide how they would connect.</p> <p>Since we have implemented the mediator pattern for interaction between the queue server, administrator GUI, bank adapter, and the table, we could have also had the HHDs connect to the mediator. However, this would increase the traffic through the mediator, as well as its complexity because multiple ports would be needed to connect to all the HHDs at the table.</p> <p>Instead, we decided to encapsulate all the tables inside a proxy of sorts called the table mappings. This way, we had a means to abstract the actual seats at the table away from the ports that the HHDs connect to. This means that HHDs can connect in any order to the ports on the table mappings but have no effect on what seat they are sitting at. The table mappings capsule knows what seat a player is to sit at when he connects. It knows what port to send messages to when a table wants to communicate with whatever player is seating at an absolute seat.</p> <p>This solution also allows us to limit the types of messages the HHDs can send to those a player should be able to communicate with. The mediator understands all messages, so if the players were to connect to it, there is nothing to say they can't send messages that were intended for the administrator GUI.</p> <p>Finally, by encapsulating multiple tables within the table mappings, we reduce the number of port connections between the mediator and the tables to one. Now the mediator has only single port connections to every object it communicates with, whereas without the table mappings it would have one for each HHD connected to any of the multiple tables and one for each table.</p>	

Decision Description	Identifier
Table and Logic	DD-006
<p>After encapsulating all table responsibilities within the table mappings (see DD-005), any further division of responsibility had to be decided upon.</p> <p>The team could have easily decided to put all logic and state related to the game of poker together within the table capsule without any further abstractions. This would have certainly made the poker game logic less complex because messages would not have to be passed between capsules or sub capsules.</p> <p>However, we felt that the ability to play other betting and card based games, such as blackjack, would be of huge benefit to Juan Pablo Enterprises, who would not likely wish to pay for a whole new blackjack system made from scratch unnecessarily. As such we carefully divided responsibility into two capsules: the table capsule and a plug-in sub-capsule we generically call the "game logic."</p> <p>The message protocol between the table and the game logic is designed to be generic enough to work for any game that deals cards (player or communal) and facilitates betting. The game does not even require a player to be the dealer, because although one signal has the table send a rotating dealer, it may be safely ignored by the game logic. Game states could be modified and interpreted based on the current game the table knows it is playing.</p> <p>It is also worth noting that state such as the amount of money the players have to bet with is kept outside the game logic, since it will not change for different kinds of games.</p>	

07 REFERENCES

The section lists sources for all external resources used to develop the Electronic Poker System. Annotated to each source, is a brief description of its occurrence within the system.

