

# Aplicació mòbil alternativa del joc clàssic “Pong”

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## FITXA DEL TREBALL FINAL

<b>Títol del treball:</b>	<i>Aplicació mòbil alternativa del joc clàssic "Pong"</i>
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<b>Àrea del Treball Final:</b>	<i>Desenvolupament aplicacions dispositius mòbils (Android)</i>
<b>Titulació:</b>	<i>Enginyeria tècnica d'Informàtica de Sistemes</i>

### **Resum del Treball (màxim 250 paraules):**

L'objectiu és el desenvolupament d'una aplicació de tipus lúdic per un o dos jugadors.

La idea és fer una variant del joc clàssic "Pong". El joc original tracta d'una pilota que està en moviment i que rebotja contra les parets de la pantalla. Cada jugador controla una pala que protegeix una zona buida on no hi ha paret. Els jugadors han de fer que la pilota reboti contra la seva pala i evitar que es perdi fora de la pantalla. Cada cop que no es pugui tornar la pilota, suposarà un punt per l'altre jugador.

La variant sobre el joc original que proposo seria la de fer un joc per torns, on la pilota s'aturaria a la meitat de la pantalla i s'hauria d'encertar la trajectòria per aconseguir posar la pala al lloc correcte i que la pilota reboti. D'aquesta manera, no caldrà que els jugadors hagin d'estar pendents contínuament del joc, sinó que només hauran d'intervenir quan sigui el seu torn.

Per regular la jugabilitat i afegir dificultat, el joc es podria iniciar amb una pala d'una mida bastant gran que permeti tornar la pilota amb certa facilitat, i a mida que el joc s'allargui, es faria progressivament més petita o bé aturant la pilota cada cop abans.

La variant per només un jugador amb una pala es podria fer amb un comptador que marqui les vegades que és capaç de tornar la pilota contra una paret.

**Abstract (in English, 250 words or less):**

The aim is to develop a playful application for one or two players. It will be a variant of the classic game "Pong." The original game is a ball that is moving and bouncing against the walls of the screen. Each player controls a paddle that protects an empty area where there is no wall. Players must make the ball bounce against their paddle and avoid get out of the screen. Every time the ball can not be returned, it will be a point to the other player. The variant of the original game I propose would be to turn a game where the ball would stop in the middle of the screen and should hit the trajectory to get to the right place and the ball bounces. Thus, players will not have to constantly be aware of the game, but will play only when it's their turn. To adjust difficulty, the game could begin with a paddle in a size large enough to allow the ball back quite easily but it will be progressively smaller or stop ever before.

The only variant for a player with a paddle could be a counter that tells how many times the player can return the ball against a wall.

**Paraules clau (entre 4 i 8):**

Pong multijugador pilota online clàssic joc

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# 1. Introducció

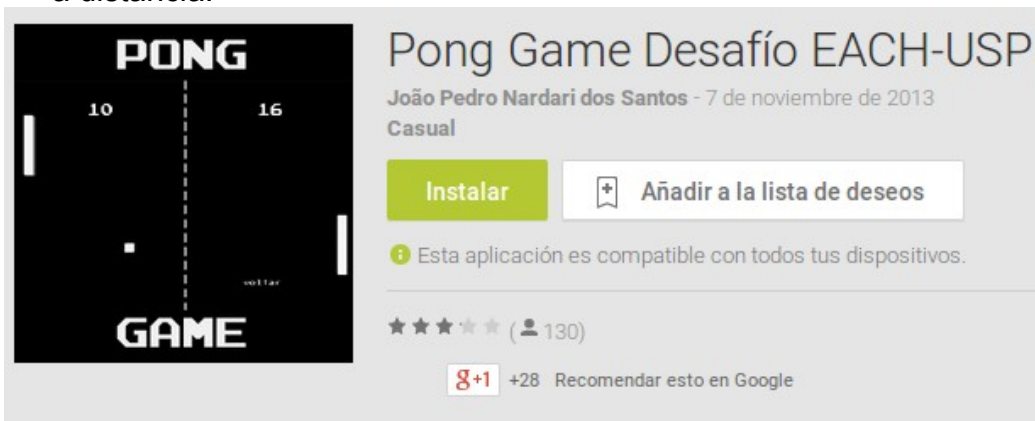
## 1.1 Context i justificació del Treball

Malgrat que està basat en un joc clàssic de fa molts anys, no he trobat cap variació que permeti jugar d'una manera més intermitent per poder fer altres coses en mig d'una partida. Això pot afavorir que es pugui jugar una partida llarga encara que no es disposi de gaire temps lliure.

A més, amb un servidor disponible on es puguin centralitzar les dades de la partida en curs, no caldria que els dos jugadors juguessin la partida al mateix dispositiu.

Tot plegat, crec que ajuda a millorar la diversió i adapta el concepte clàssic a la manera de funcionar de les aplicacions modernes: interconnexió d'usuaris i mobilitat.

Exemples d'aplicacions similars a Google Play però sense opció de jugar a distància:



**Pong Game Desafío EACH-USP**  
João Pedro Nardari dos Santos - 7 de noviembre de 2013  
Casual

[Instalar](#) [Añadir a la lista de deseos](#)

Esta aplicación es compatible con todos tus dispositivos.

★★★★☆ (130)

[g+1](#) +28 Recomendar esto en Google



**Ping Pong Free**  
Ashwood Studios - 2 de abril de 2012  
Arcade

[Instalar](#) [Añadir a la lista de deseos](#)

Esta aplicación es compatible con todos tus dispositivos.

★★★★☆ (883)

[g+1](#) +228 Recomendar esto en Google

## 1.2 Objectius del Treball

L'objectiu és la creació d'una aplicació que permeti jugar a dos usuaris entre sí tot i que no estiguin al mateix lloc. L'aplicació haurà de sincronitzar la partida i els moviments, transmetent la informació mitjançant internet. Per això caldrà el suport d'un servei o servidor que farà d'intermediari entre els dispositius.

A aquesta modalitat de joc, serà necessari que els dispositius estiguin connectats a la web, encara que està previst un mode d'un sol jugador *offline*.

S'intentarà que l'aplicació funcioni al major nombre de dispositius, tant de mòbils com de tauletes, independentment de les característiques de les seves pantalles.

## 1.3 Enfocament i mètode seguit

La implementació de l'aplicació es farà des de zero i només s'adoptarà la idea del joc original pels conceptes bàsics.

Com he indicat anteriorment, la base està inspirada al joc "Pong", creat per Nolan Bushnell a l'any 1972 i publicat per "Atari"[1].

## 1.4 Planificació del Treball

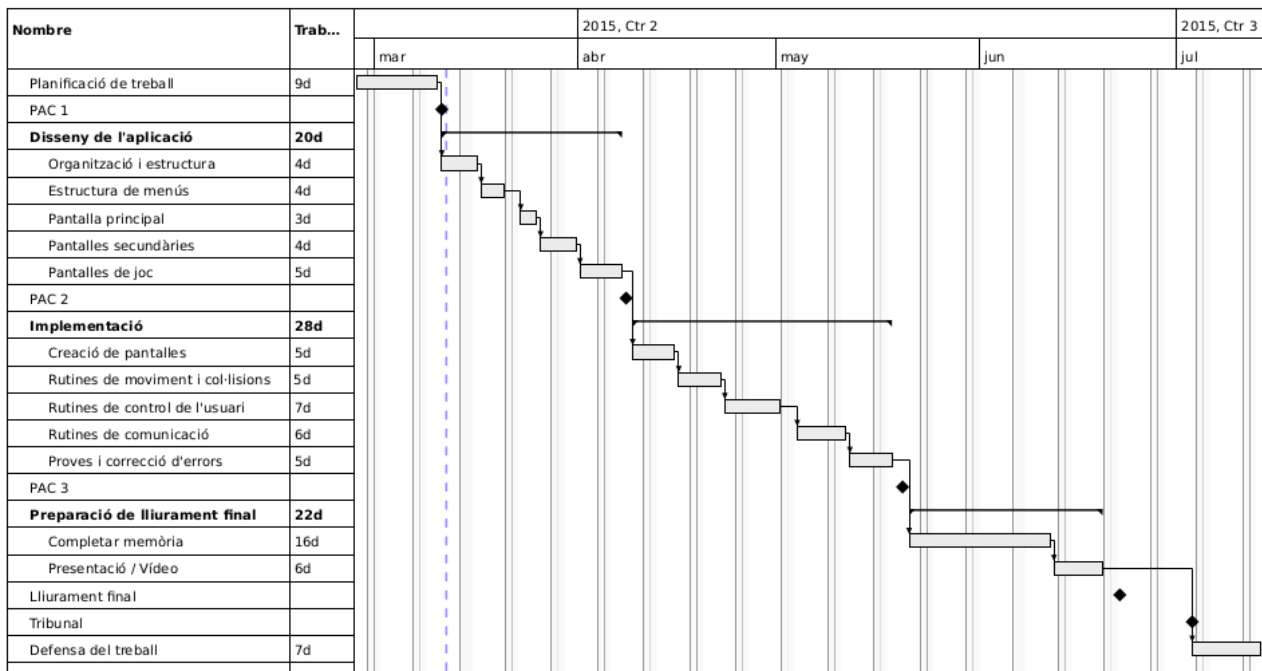
Per la realització del projecte utilitzaré un entorn de desenvolupament d'aplicacions com Android Studio.

S'ha de tenir en compte el període de temps per la instal·lació, configuració i procediments bàsics de l'entorn de desenvolupament (IDE) per començar a crear aplicacions Android.

També cal estimar un temps d'aprenentatge inicial i temps de marge per resoldre futures incidències amb errors provocats per la inexperiència.

Per intercanviar la informació entre dispositius utilitzaré serveis com parse o google cloud. Cada dispositiu pujaria dades al servidor amb la informació actual de la partida (fonamentalment, un identificador de la partida que s'està jugant i els valors que defineixen la trajectòria de la pilota). Cal definir els valors que s'han de transmetre i els paràmetres de connexió amb el servidor.

En base a això i als lliuraments parcials que s'han de fer (PACs) he confeccionat la següent planificació:



### 1.5 Breu resumari de productes obtinguts

El producte final serà una aplicació instal·lable i executable a qualsevol dispositiu amb el sistema Android. La versió mínima probablement serà la 4.0 que abarca un nombre considerable de dispositius (per sobre del 80%), encara que això dependrà de les funcions de sistema que es facin servir.

### 1.6 Breu descripció dels altres capítols de la memòria



## 2. Disseny tècnic

### 2.1. Definició de casos d'ús



En aquest esquema, només un jugador pot iniciar una partida i jugar una partida individual. En canvi, per la partida de dos jugadors calen interactuar ambdós jugadors.

Identificador	CU-001
Nom	Inicia partida
Prioritat	Normal
Descripció	Inicia una partida individual o de dos jugadors
Actors	Jugador 1
Pre-Condicions	No tenir cap partida ja iniciada
Iniciat per	Jugador 1
Flux	Menú de selecció de partida
Post-Condicions	Es genera una partida nova amb les condicions apropiades (1 o 2 jugadors)
Notes	En funció de la partida escollida, el flux es bifurcarà a les opcions d'un o dos jugadors, selecció de paràmetres addicionals (connexió, etc)

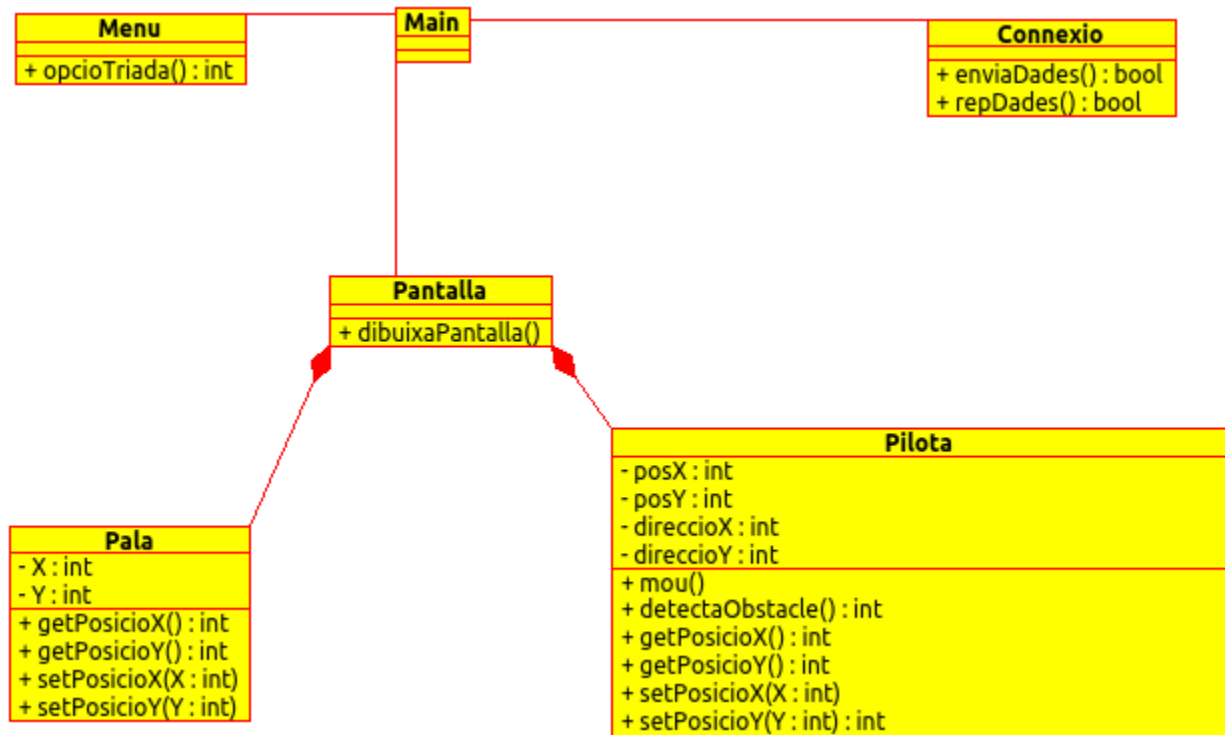
Identificador	CU-002
Nom	Partida 1 jugador
Prioritat	Normal
Descripció	Genera partida individual
Actors	Jugador 1
Pre-Condicions	S'ha triat el mode de joc individual
Iniciat per	Jugador 1
Flux	Generació d'entorn per joc individual
Post-Condicions	Registra que s'ha iniciat una partida

Notes	
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Identificador	CU-003
Nom	Partida 2 jugadors
Prioritat	Normal
Descripció	Genera partida per dos jugadors
Actors	Jugador 1 i jugador 2
Pre-Condicions	S'ha triat el mode de joc per dos jugadors i s'han definit els paràmetres per jugar
Iniciat per	Jugador 1
Flux	Generació d'entorn per joc de dos jugadors
Post-Condicions	Registra que s'ha iniciat una partida per dos jugadors i es prepara per possibilitar la transmissió de dades.
Notes	

## 2.2. Disseny de l'arquitectura

### - Esquema de classes:



Partint de la classe principal, tenim diferents classes relacionades:

*-Menu:* Controla les opcions dels menús i l'opció triada.

*-Pantalla:* La seva utilitat es la de mostrar la pantalla de joc

Aquesta classe està composta per dues més:

- *Pilota:* Conté les dades de la pilota i els mètodes per controlar el seu moviment.

Els atributs *posicioX* i *posicioY* determinen la posició actual de la pilota.

El mètode *detectaObstacle* comprova si hi ha cap obstacle al costat de la pilota i retorna un enter indicant la posició de l'obstacle o 0 si no n'hi ha cap.

El mètode *mou* calcula la nova posició de la pilota afegint la *direccioX* a *posicioX* i *direccioY* a *posicioY* o invertint la direcció si hi ha cap obstacle.

*-Pala:* Enmagatzema els atributs necessaris per controlar les pales.

*-Connexió:* Estableix la connexió amb el servidor.

Implementa els mètodes per enviar i rebre dades al servidor.

### **-Dades de l'aplicació:**

La informació necessària per l'aplicació es guarda als atributs de les classes. L'intercanvi d'informació es fa per connexions puntuals al servidor amb enviament/recepció de les següents dades:

*-cod\_partida:* identificador únic de partida

*-id\_jugador:* identificador únic de jugador

*-posXpilota:* posició X de la pilota

*-posYpilota:* posició Y de la pilota

*-direccioX:* direcció X de la pilota

*-direccioY:* direcció Y de la pilota

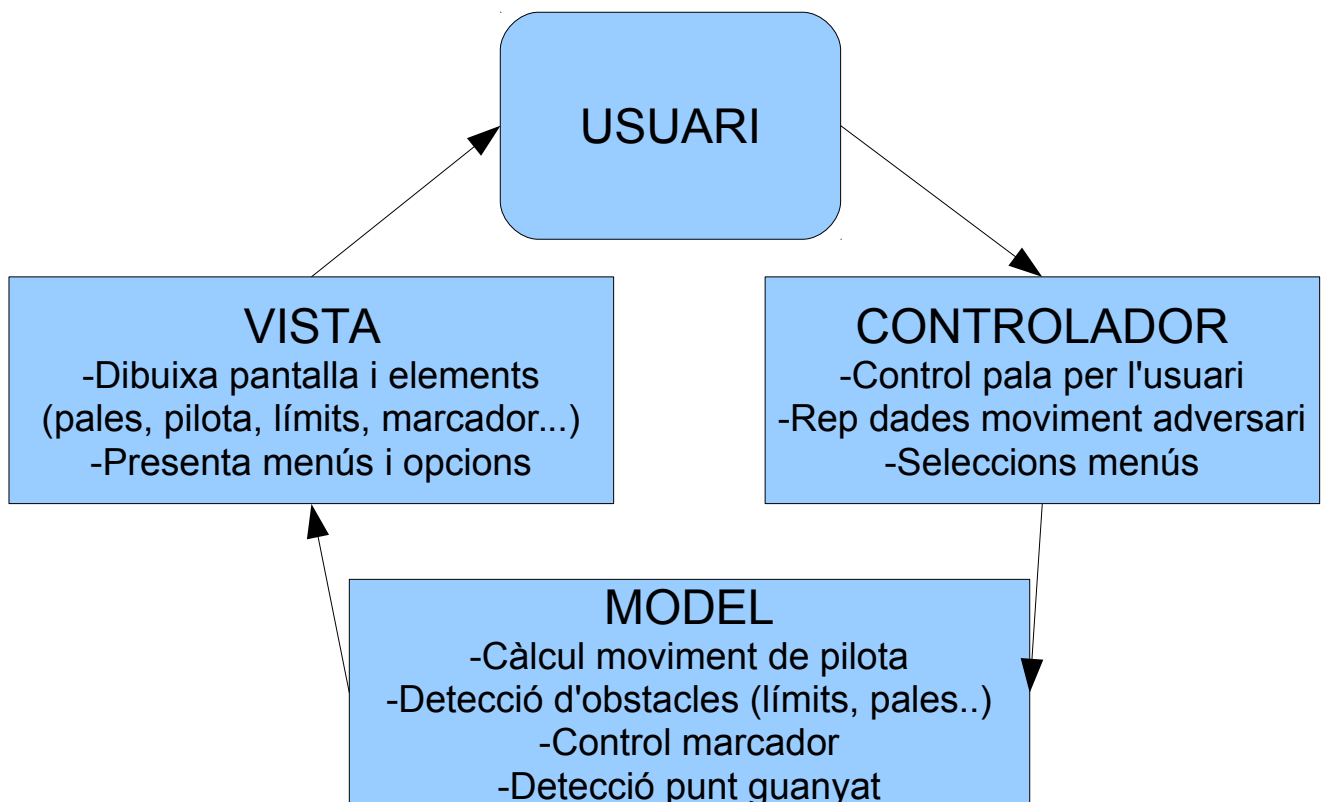
*-posYpala:* posició Y pala jugador

*-missatgeText:* missatge de text enviat pel jugador

El mètode d'intercanvi de la informació que he triat és mitjançant un servei de hosting a parse.com donat que l'estructura necessària és molt senzilla i amb aquest servei és suficient.

#### **-Paradigma de programació:**

Per aquesta aplicació he decidit fer servir el paradigma MVC (Model-Vista-Controlador) perquè m'ha semblat més apropiat:



L'usuari interactua amb el controlador, que recull les opcions triades, la posició on es vol posar la pala...

Totes aquestes dades es passen al model, que gestiona la informació. El model s'encarrega de controlar el funcionament intern de l'aplicació: accions dels menús, detecció d'obstacles, càlcul del moviment de la pilota.

Finalment, la vista presenta el resultat del model a l'usuari per la pantalla: dibuixa límits, pantalla, pales...

### 2.3. Usuaris i contextos d'ús

En primer lloc, es realitzen diferents entrevistes a un grup petit de persones amb la finalitat d'aconseguir suficient informació qualitativa que ens permeti establir una base sobre els punts més importants a tenir en compte.

S'intenta que els perfils dels usuaris per les entrevistes sigui el més variat possible. D'aquesta manera, obtenim una representació més acurada del diferents usuaris que podrien fer servir la nostra aplicació. L'entrevista ens dóna molta informació i de bona qualitat, aprofundint en les aficions i les motivacions dels usuaris.

Un cop definits els punts principals més valuosos pel nostre estudi, es poden complementar amb altres mètodes de tipus quantitatiu, tal com les enquestes, que ens proporcionarà informació d'un ventall més gran de persones.

Segons la informació rebuda a la fase d'indagació, es poden distingir els següents perfils fonamentalment:

#### -Perfil 1:

Usuari ocasional

Rang d'edat superior als 55-60 anys

Coneixements molt bàsics sobre tecnologia mòbil

Motivació baixa per provar programes i aplicacions noves

Molt poca experiència amb tecnologia mòbil

Conclusions: Seria de gran ajuda per aquest tipus d'usuari facilitar un mode de joc "bàsic" on les opcions ja estiguin establertes i predefinides amb l'objectiu que l'usuari no es perdi en un munt d'opcions. Per això, es pot posar a la pantalla principal una opció de "partida ràpida" i, dins aquesta opció, poder triar joc individual o dos jugadors sobre el mateix dispositiu. Les opcions de connexió són massa complexes per aquest perfil d'usuari.

#### -Perfil 2:

Usuari ocasional

Edat entre els 30 i 50 anys

Coneixements bàsics d'usuari amb tecnologies mòbils

Experiència moderada amb mòbils

Motivació ocasional per provar aplicacions mòbils

Conclusions: Aquest perfil d'usuari pot fer servir el mode "partida ràpida" i, ocasionalment, provar opcions més avançades.

-Perfil 3:

Usuari intensiu

Edat entre 16 i 45 anys

Coneixements superiors a l'usuari promig

Molta experiència amb ús de mòbils

Alta motivació per provar noves aplicacions

Conclusions: A aquest perfil, el mode bàsic es queda curt. La configuració d'opcions avançades és la més indicada per a ells.

Una idea de funció afegida seria la possibilitat d'enviar un missatge de text després de cada torn. Això podria augmentar la interacció dels usuaris i l'adició. Com que seria una funcionalitat que no augmentaria la complexitat de l'aplicació d'una manera important per a un usuari bàsic, és una opció a considerar per a qualsevol tipus d'usuari (per exemple, afegint un quadre de text buit a sobre del botó per passar el torn).

## 2.4. Disseny conceptual

Degut a la naturalesa lúdica de l'aplicació, no hi ha una motivació o necessitat específica en un moment concret, més enllà de la disponibilitat d'una estona de temps lliure.

L'Antoni té 45 anys i és administratiu: «No m'agraden els jocs d'ordinador que t'enganxen i et demanen molt de temps, però amb aquest tipus de joc per torns jugo quan decideixo i quan em va bé, a més que per fer el meu moviment només em calen 5 segons».

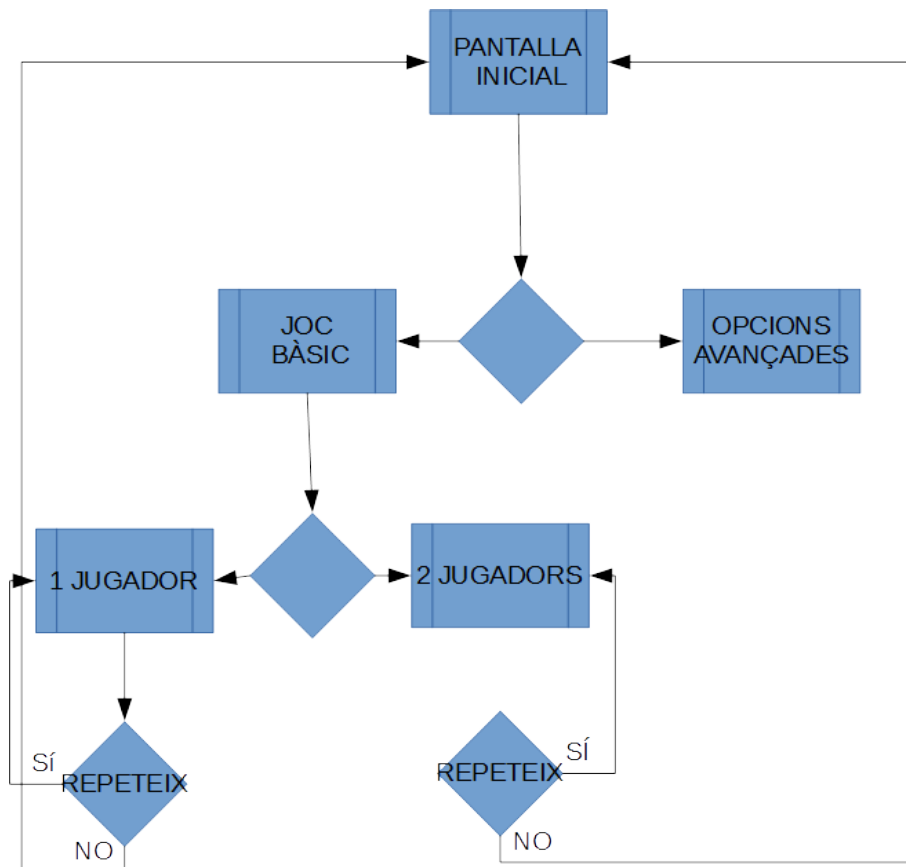
Exemples d'escenaris d'ús:

-L'Àngels té 65 anys i està esperant l'autobús. Mentres espera, obre l'aplicació i amb un parell de clicks ja es troba jugant el mode de joc individual.

-En Marc i en Jaume tenen 25 i 28 anys respectivament i són estudiants. Cadascú és a casa seva i es repton a una partida per dos jugadors per internet.

-En Joan i la Laura tenen 40 anys. No tenen gaire temps per jugar a causa de la seva feina, però no tenen problema per jugar partides de dos jugadors per internet mentres que s'envien missatges a cada torn. El fet que cadascú faci el seu moviment quan tingui temps disponible els permet jugar intermitentment.

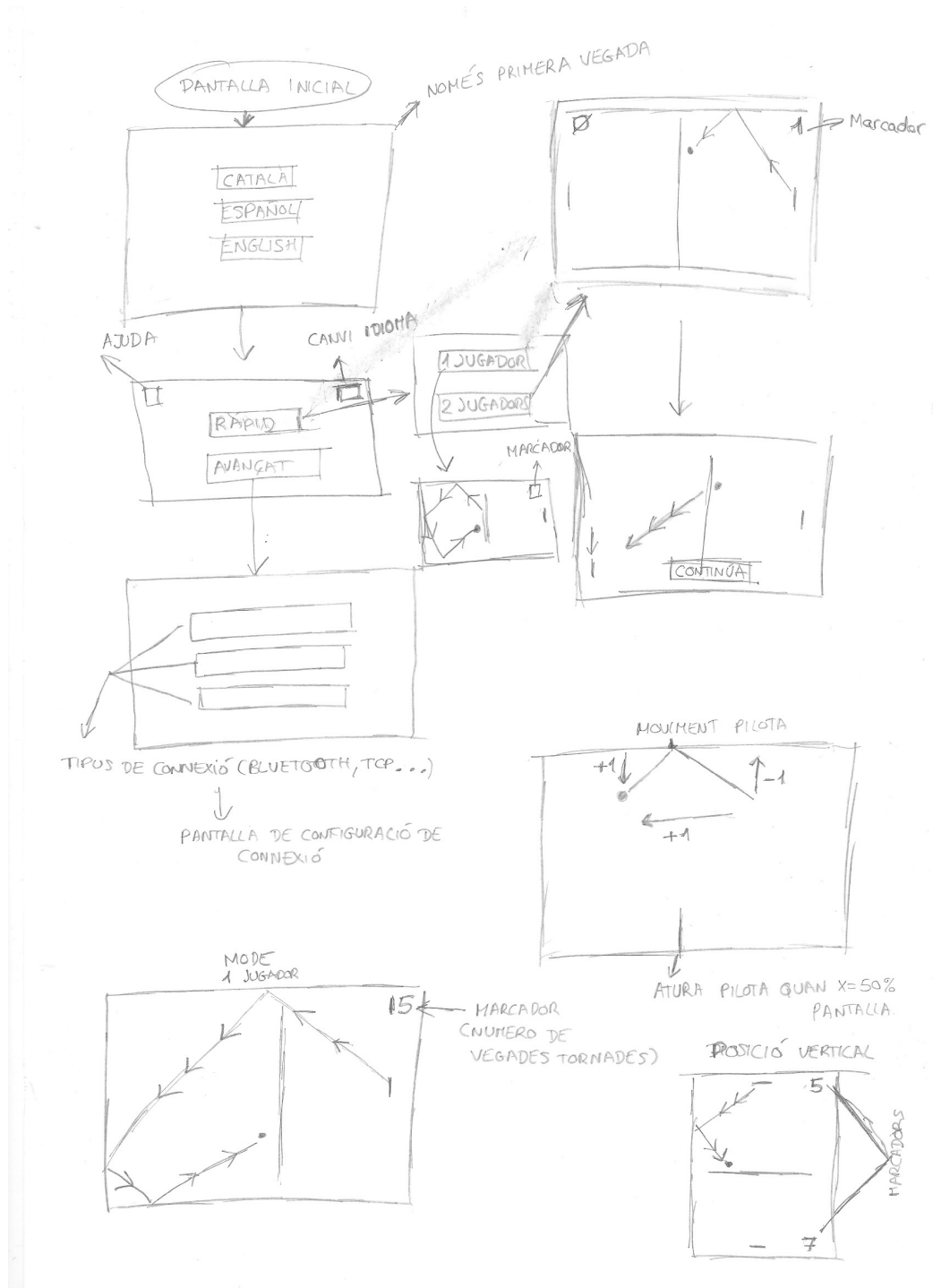
Flux d'interacció:





## 2.5. Prototipatge

Sketch inicial:



Prototipus:

He mantingut l'aspecte clàssic de l'original amb imatges molt bàsiques, encara que és un disseny que pot tenir variacions a la versió final i potser afegeixo més color i altres efectes segons les orientacions dels usuaris.

També falta afegir a la part de dalt el títol amb el nom de l'aplicació (encara per decidir).

Pantalla de selecció d'idioma:

Aquesta pantalla s'executaria la primera vegada que s'executés l'aplicació i quan es seleccioni el botó de canvi d'idioma:



Pantalla inicial:

Tria el mode de joc.

També incorpora un botó per canviar l'idioma si es desitja i un altre d'ajuda que donarà una informació bàsica del funcionament del joc.

AJUDA

IDIOMA

## MODE DE JOC

RĂPID

AVANÇAT

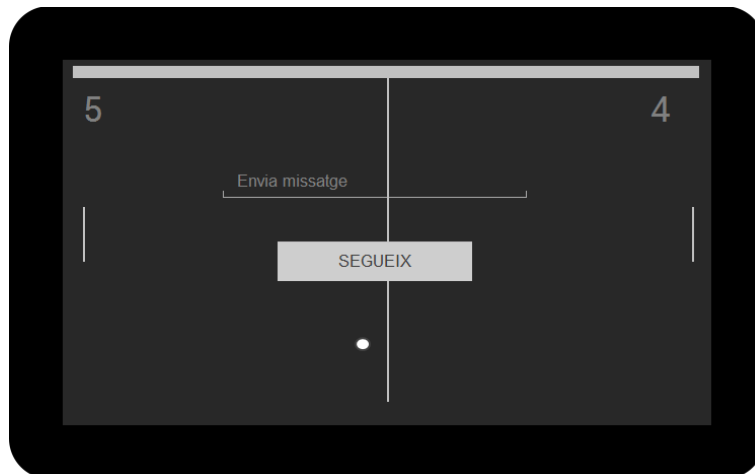
Pantalla per a un jugador:



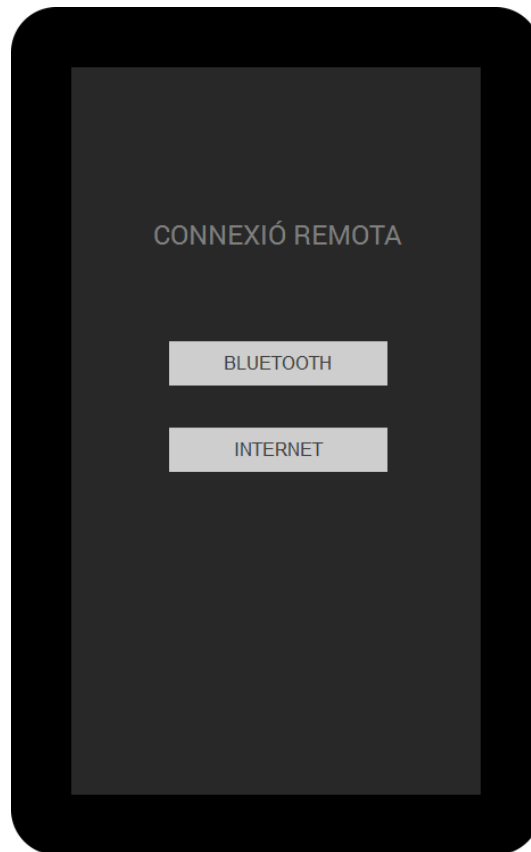
Pantalla per 2 jugadors:



Disseny horitzontal de la mateixa pantalla:



Pantalla per opcions avançades:



## 2.6 Avaluació

-Qüestionari per avaluació de l'aplicació per l'usuari:

Edat:

Sexe:

Activitat laboral:

Té mòbil propi?

En cas afirmatiu: Té instal·lats jocs al mòbil?

Tipus de joc que prefereix:

-Jocs individuals

-Multijugador per torns

-Multijugador simultani o en temps real (juguen tots dos alhora)

-No m'agraden els jocs. Per què? (manca de motivació, temps, desconeixement...)

-Tasques a realitzar per l'usuari

- Inicia una partida senzilla en joc individual
- Inicia una partida en multijugador i configura la connexió
- Un cop acabada una partida, inicia una altra
- Obtenir ajuda bàsica sobre el funcionament de l'aplicació
- Canvia l'idioma de l'aplicació

-Preguntes referents a les tasques

T'ha semblat difícil?

Quins passos et sembla que no són necessaris o es podrien estalviar?

Hi ha alguna cosa que no has entès correctament? Quina?

Què milloraries de l'aplicació?

## 2.7. Desenvolupament

- ENTORN

L'entorn de desenvolupament que he fet servir ha estat Android Studio. És un entorn relativament nou però que ha tingut un creixement molt ràpid. L'altre entorn que havia considerat era fent servir Eclipse.

M'he decidit per Android Studio perquè és l'entorn oficial i recomenat per la mateixa Google, empresa responsable de Android i, per tant, se suposa que és el futur de desenvolupament de la plataforma.

És un entorn bastant intuïtiu, i amb un grau de maduresa apreciable, amb actualitzacions constants. L'última actualització que estic fent servir és la 1.2.1.1 sobre linux.

- SDK i APIs

La versió mínima del SDK per poder executar el programa és la 15 (Android 4.0.3). Segons les dades proporcionades per Google, l'aplicació funcionaria a

més del 90% dels dispositius Android, per tant, em semblen uns mínims molt raonables.

El programa s'ha provat a més del simulador a:

- Samsung Galaxy S2 amb Android 4.4.4
- Samsung Galaxy Express 2 amb Android 4.4.2
- Asus TF101 amb Android 4.4.4

## COMENTARIS SOBRE EL CODI

Les APIs bàsiques que he utilitzat han estat:

- Canvas* pels gràfics i les animacions
  - View* pel tractament de la pantalla, sobretot per detectar quan es toca la pantalla amb el mètode implementat *onTouchEvent*.
  - El *widget Button* amb el mètode *setOnClickListener* per el tractament dels botons a la pantalla i les seves pulsacions.
  - Com a dependències externes he afegit la llibreria *parse[2]* per poder utilitzar el servei de *parse.com*. La llibreria està sota la llicència Apache 2.0 i inclou altres dependències amb la mateixa llicència. El document de les llicències està inclòs a l'apartat d'annexos.
  - La implementació de la pantalla de joc està feta sobre *canvas*. Per tenir el mateix comportament independentment del dispositiu i la resolució he creat una pantalla virtual de 500X1000 píxels. A l'inici, es determina el rati de la pantalla real del dispositiu sobre aquesta pantalla virtual.
- Tots els moviments y les deteccions es fan sobre aquesta pantalla virtual i quan s'han de presentar els objectes a la pantalla real del dispositiu es fa un escalat.
- L'aplicació requereix el permís de poder utilitzar la connexió de dades per poder connectar-se a internet al joc online.

## - ESTAT DE L'APLICACIÓ I MILLORES

La funcionalitat de l'aplicació ha canviat bastant del que estava dissenyat.



He dividit l'aplicació en un mode arcade (temps real sense aturades) i un altre per torns.

El joc «arcade» es desenvolupa en temps real sense aturar-se molt semblant al joc clàssic però, a diferència d'altres versions, no s'atura quan no es torna la pilota, sinò que continua actualitzant el marcador. Aquests canvis sembla que afavoreixen l'adicció quan es juga al mateix dispositiu sobretot amb dos jugadors alhora. Per aquest motiu, la meua idea ha estat mantenir les dues modalitats de joc i poder triar entre joc simultani i joc per torns.

Un altre canvi és al tanteig al mode d'un jugador, quan es torna la pilota es suma un punt i quan es falla, el resta.

A més del punt anterior, hi ha una sèrie de possibles millores que es podrien fer sobre l'aplicació:

- Afegeix botó d'inici de partida o compte enrere abans que la pilota es posi en moviment.
- Millora dels gràfics, potser afegint un fons o el disseny de la pilota i les pales.
- Neteja i reutilització de codi. El codi es pot optimitzar i reutilitzar, hi han part comunes a la modalitat d'un i dos jugadors per exemple.
- Disseny de l'icona de l'aplicació.
- Funcionament del joc amb la pantalla horitzontal o no.
- Ajustar la jugabilitat afegint-hi dificultat (més velocitat o reduint la mida de les pales).

## b. Proves

Les proves prèvies es realitzen sobre simulador per després provar a un dispositiu físic.

Pantalla inicial:



-Selecció de mode 1 o 2 jugadors.

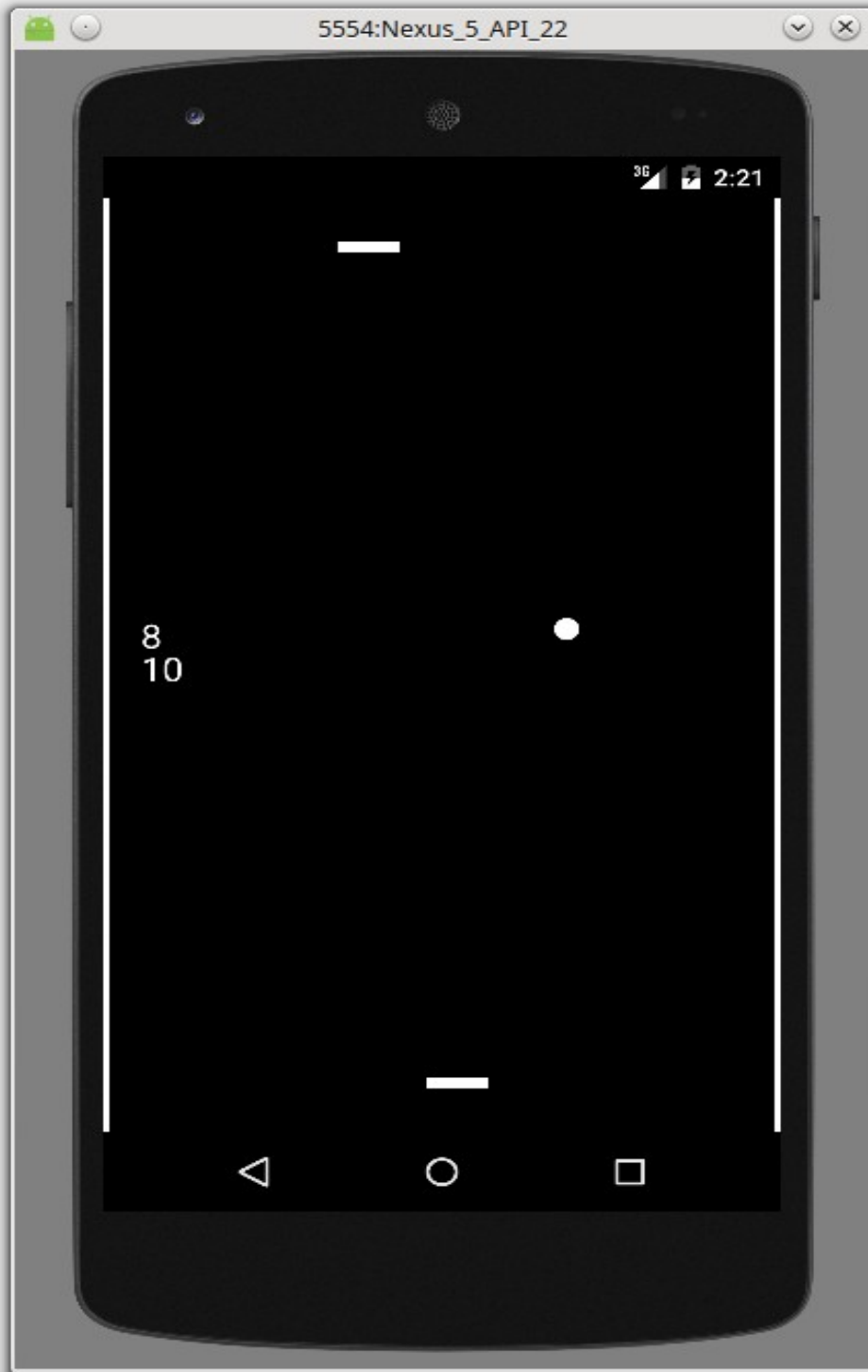
Pantalla 1 jugador:



-Control tàctil de la pala

- Comprovació que la pilota reboti correctament contra els laterals i la pala.
- Comprovar que el marcador compta correctament.

Pantalla 2 jugadors:



-A més de les comprovacions semblants al mode de 1 jugador, es comproven els dos marcadors i sobretot que el sistema *multitouch* (dues deteccions alhora) funciona correctament, d'aquesta manera és possible jugar els dos jugadors alhora simultàniament.

-Fent servir el botó d'anar enrera es torna al menú principal. Si es torna a pitjar, se surt de l'aplicació.

### 3. Conclusions

El desenvolupament d'aquesta aplicació m'ha permès practicar sobre diferents aspectes de la programació a android. A més de les qüestions bàsiques com la creació i gestió d'activitats, implementació de controls com botons... també m'ha calgut documentació sobre el funcionament de diversos elements:

- Canvas per representació gràfica
- Tractament de sons
- Captura d'events quan es toca la pantalla, sobretot quan es toquen varios punts alhora (multitouch)
- Intercanvi de dades client-servidor (parse.com)

## 4. Glossari

## 5. Bibliografía

[1] <http://es.wikipedia.org/wiki/Pong> (26/02/15)

[2] <https://www.parse.com/>

<http://www.sgoliver.net/blog/curso-de-programacion-android/indice-de-contenidos/> (20/03/15)



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