Mestrado Integrado em Engenharia Informática e Computação

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Home Gym

A mobile application for workout challenges

Angelo Miguel Tenreiro Teixeira , up201606516
Henrique Melo Lima , up201606525
Rui Pedro Moutinho Moreira Alves , up201606746

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What is home gym?

Home Gym is a mobile application for challenging other people to do workout with you in a fun and interactive way. You get rewards by completing challenges and get feedback on how well you did, to help you improve for next time!

Our idea with this project is to create a Database to manage all the user and app information, keeping track of all the user's statistics, all on-going challenges, types of exercises, user reviews, and others (this subject will be specified in the following chapter).

Project's Specification

Any person using the application is a **User**. The user connects to the app with its facebook account, being characterized by his facebook ID, nickname, and by his score, calculated from the scores of all the challenges the user has participated in.

A **User** can participate in more than one **Challenge** at a time. Each Challenge is composed by an ID, by a start and ending date and information about if the challenge is public [1] or not. In each challenge there can be 2 or more participants. When the Challenge is created, it is also specified in which **Week days** the **Exercise Plan** associated to the Challenge should be executed (e.g. , the Challenge consists in completing an exercise plan every Monday, Wednesday and Friday from 15-03-2018 to 20-04-2018).

Associated to each challenge the user is participating in are stored its **Participation Details**, composed by the user's score in that challenge, the rating the user gives to that Challenge (after challenge is completed / after the user gives up) and the various **Executions** of the exercise plan related to that Challenge. Each Execution consists in the duration and the date the user completed that execution (so that the user can keep track of improvements).

An **Exercise Plan** is composed by it's unique ID, a recommended cooldown (number of days that are recommended between Exercise Plan executions) and by its difficulty (calculated by the average difficulty of the **Exercises** that compose the Exercise Plan). An **Exercise Plan** can be a **Default Plan** (created by the app developers) or it can be a **Custom Plan** (created by an User). A Custom Plan can be public [1] or not and saves the date of the last time it was used.

An **Exercise** is composed by its unique ID, a name, a description, an image (that visually describes the exercise), a link to a video that explains how the exercise should be executed, its difficulty (rated from 1 to 5) and its **Exercise Type**, which can be *Endurance, Strength, Flexibility* or *Balance*

An exercise can be associated to many different exercise plans, and an Exercise Plan is composed by one or more Exercises. For each Exercise in an Exercise Plan, there are **Exercise Parameters**, that is, the number of

repetitions and number of sets for that Exercise execution (e.g. , 3 sets of 10 repetitions of push-ups , 3*10 = 30 push-ups).

An **Exercise** can, simillarly to an Exercise Plan, be a **Default Exercise** (created by the developers) or it can be a **Custom Exercise** (created by an User). A Custom Exercise can be public [1] or not.

(1) – public : visible to other Users

Conceptual Model

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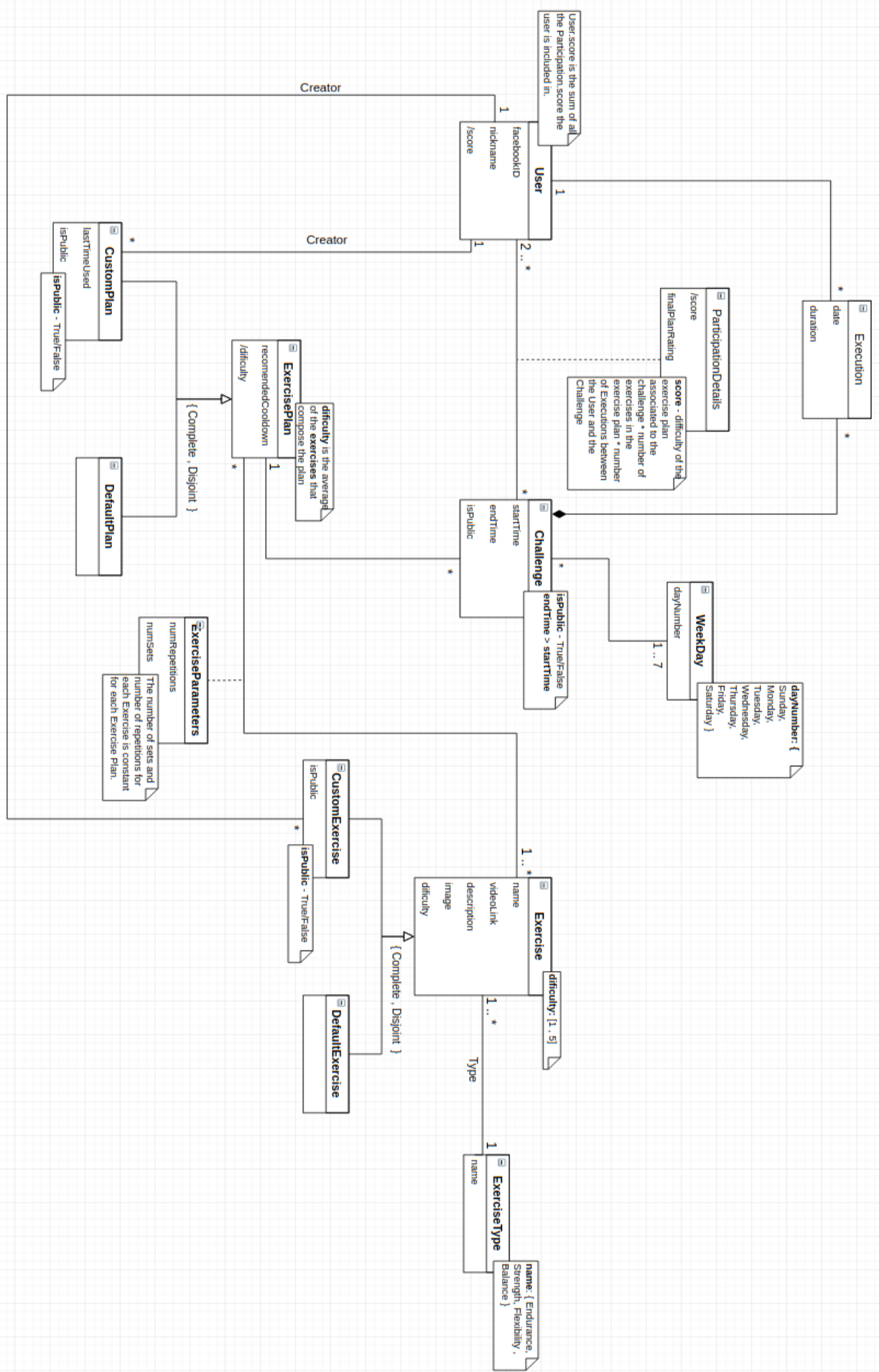
The conceptual model displayed above can also be found in a file attached to the submission (**Conceptual Model.png**) for an easier view.

RELATIONAL MODEL

User (<u>facebookID</u>, nickname, score)
    facebookID → nickname, score
    facebookID is the *primary key*
    score is a *derived attribute*

Challenge (<u>id</u>, startTime, endTime, isPublic, exercisePlan→ExercisePlan)
    id → startTime, endTime, isPublic, exercisePlan
    id is the *primary key*
    id and exercisePlan are *foreign keys*

ParticipationDetails (<u>user</u>→User, <u>challenge</u>→Challenge, score, finalPlanRating)
    user, challenge → score, finalPlanRating
    user and challenge are the *composite primary key*
    user and challenge are *foreign keys*
    score is a *derived attribute* (as explained in a future chapter)

Execution (<u>id</u>, date, duration, user→User, challenge→Challenge)
    id → date, duration, user, challenge
    id is the *primary key*
    user and challenge are *foreign keys*

WeekDay (<u>id</u>, dayName)
    id → dayName
    id is the *primary key*

ExercisePlan (<u>id</u>, recomendedCooldown, difficulty)
    id → recomendedCooldown, difficulty
    id is the *primary key*
    difficulty is a *derived attribute* (as explained in a future chapter)

CustomPlan (<u>id</u>→ExcercisePlan, lastTimeUsed, isPublic, creator→User)
    id → lastTimeUsed, isPublic, creator
    id is the *primary key*
    id and creator are *foreign keys*

DefaultPlan (<u>id</u>→ExercisePlan)
    id is the *primary key*
    is is a *foreign key*

Exercise (<u>id</u>, name, videoLink, description, imageURL, difficulty, type→ExerciseType)
    id → videoLink, description, imageURL, difficulty, type
    id is the *primary key*
    type is a *foreign key*

CustomExercise (<u>id</u>→Exercise, isPublic, creator→User)
    id → isPublic, creator
    id is the *primary key*
    id and creator are *foreign keys*

DefaultExercise (<u>id</u>→Exercise)
    id is the *primary key*
    id is a *foreign key*

ExerciseParameters (exercisePlan→ExercisePlan, exercise→Exercise, numRepetitions, numSets)

      exercisePlan, exercise → numRepetitions, numSets

      exercisePlan and exercise are the *composite primary key*

      exercisePlan and exercise are *foreign keys*

ExerciseType (id, name)

      is is the *primary key*

ChallengeDay (challenge→Challenge, weekDay→WeekDay)

      challenge and weekDay are the *composite primary key*

      challenge and weekDay are *foreign keys*

FUNCTIONAL DEPENDENCIES AND NORMAL FORM ANALYSIS

In each of the relatitions described in the previous chapter, the left side of the functional dependencies is a key for that relation, that is, the closure of the attributes in the left side is **all** the attributes in that relation, as shown in the following paragraphs:

User:
$\{$ facebookID $\}^+$ = $\{$ facebookID, nickname, score $\}$

Challenge:
$\{$ id $\}^+$ = $\{$ id, startTime, endTime, isPublic, exercisePlan $\}$

ParticipationDetails:
$\{$ user, challenge $\}^+$ = $\{$ user, challenge, score, finalPlanRating $\}$

Execution:
$\{$ id $\}^+$ = $\{$ id, date, duration, user, challenge $\}$

WeekDay:
$\{$ id $\}^+$ = $\{$ id, dayName $\}$

ExercisePlan:
$\{$ id $\}^+$ = $\{$ id, recomendedCooldown, difficulty $\}$

CustomPlan:
$\{$ id $\}^+$ = $\{$ id, lastTimeUsed, isPublic, creator $\}$

DefaultPlan:

$\{\,id\,\}^+ = \{\,id\,\}$

Exercise:

$\{\,id\,\}^+ = \{\,id,\ name,\ videoLink,\ description,\ image,\ difficulty,\ type\,\}$

CustomExercise:

$\{\,id\,\}^+ = \{\,id,\ isPublic,\ creator\,\}$

DefaultExercise:

$\{\,id\,\}^+ = \{\,id\,\}$

ExerciseParameters:

$\{\,exercisePlan,\ exercise\,\}^+ = \{\,execisePlan,\ exercise,\ numRepetitions,$
$numSets\,\}$

ExerciseType:

$\{\,id\,\}^+ = \{\,id,\ name\,\}$

ChallengeDay:

$\{\,challenge,\ weekDay\,\}^+ = \{\,challenge,\ weekDay\,\}$

Therefore, since in each of the relations the left side of the functional dependencies is a key for that relation, the relational model is in the **Boyce-Codd Normal Form,** *BCNF* (no normal form violations were found). Since the **3rd Normal Form**, *3NF*, is a super set of the BCNF, that is, every relation in the BCNF is also in the 3NF, the relational model is also in the **3rd Normal Form**.

RESTRICTIONS

User:
- **facebookID** is the primary key (key restriction , PRIMARY KEY)
- **score** is the sum of all the *ParticipationDetails.score* the user is in (using triggers, to be implemented futurely), default value=0 (DEFAULT (0)) and can't be null (NOT NULL)
- **nickname** must have [6..48] characters and must be unique (UNIQUE) and can't be null (NOT NULL)

Challenge:
- **id** is the primary key (key restriction, PRIMARY KEY)
- **startTime** and **endTime** are both dates. *endTime* must be greater than *startTime* (check restriction, CHECK endTime >= startTime) and both can't be null (NOT NULL)
- **IsPublic** default value is *true* (DEFAULT (1)) and can't be null (NOT NULL)
- **exercisePlan** is a foreign key (referential integrity, FOREIGN KEY) and can't be null (NOT NULL)

ParticipationDetails:
- **user** and **challenge** are the composite primary key (key restriction, PRIMARY KEY(user,challenge)) and are both foreign keys (referential integrity, FOREIGN KEY)
- **finalPlanRating** default value is **Null** (Default NULL) and, if not, must $\in$ [1,10] (CHECK finalPlanRating >= 1 *and* finalPlanRating <= 10)
- **score** is calculated by multiplying the difficulty of the Exercise Plan associated to the Challenge, the number of exercises associated to that plan and the number executions between the user and the challenge (using triggers, to be implemented futurely) and can't be null (NOT NULL)
- **score** "Simplified Expression":
  score = planDifficulty * numExercisesInPlan * numExecutions

WeekDay:
- **id** is the primary key (key restriction, PRIMARY KEY)
- **dayName** can't be null (NOT NULL) and can hold the following values, with (CHECK dayName=='Monday' or dayName=='Tuesday' or …):
  - Monday
  - Tuesday
  - Wednesday
  - Thursday
  - Friday
  - Saturday
  - Sunday

ChallengeDay:
- **challenge** and **weekDay** are the composite primary key (key restriction, PRIMARY KEY(challenge,weekDay)) and are both foreign keys (referential integrity, FOREIGN KEY)

ExerciseType:
- **id** is the primary key (key restriction, PRIMARY KEY)
- **name** cannot be null (NOT NULL) and must be unique (UNIQUE)

ExercisePlan:
- **id** is the primary key (key restriction, PRIMARY KEY)
- **recomendedCooldown** can be null (not set) and, if set, must be greater or equal than one day (CHECK recommendedCooldown > 0)
- **difficulty** is the average of all the *Exercise.difficulty* associated to this plan (using triggers, to be implemented futurely)

DefaultPlan:
- **id** is the primary key (key restriction, PRIMARY KEY) and a foreign key (referential integrity, FOREIGN KEY)

CustomPlan:
- **id** is the primary key (key restriction, PRIMARY KEY) and a foreign key (referential integrity, FOREIGN KEY)
- **creator** is a forein key (referential integrity, FOREIGN KEY) and can't be null (NOT NULL)
- **isPublic** default value is *true* (DEFAULT (1)) and can't be null (NOT NULL)

Exercise:
- **id** is the primary key (key restriction, PRIMARY KEY)
- **name** cannot be null (NOT NULL)
- **description** cannot be null (NOT NULL) and its default value is "No description available" (DEFAULT 'No description available')
- **difficulty** default value is 3 (DEFAULT (3)), must be within the range [1..5] (CHECK difficulty >= 1 and difficulty <= 5) and can't be null (NOT NULL)
- **type** cannot be null (NOT NULL) and is a foreign key (referential integrity, FOREIGN KEY)

DefaultExercise:
- **id** is the primary key (key restriction, PRIMARY KEY) and a foreign key (referential integrity, FOREIGN KEY)

CustomExercise:
- **id** is the primary key (key restriction, PRIMARY KEY) and a foreign key (referential integrity, FOREIGN KEY)
- **creator** is a forein key (referential integrity, FOREIGN KEY) and can't be null (NOT NULL)
- **isPublic** default value is *true* (DEFAULT (1)) and can't be null (NOT NULL)

ExerciseParameters:
- **exercisePlan** and **exercise** are the composite primary key (key restriction, PRIMARY KEY(exercisePlan,exercise)) and are both foreign keys (referential integrity, FOREIGN KEY)
- **numRepetitions** cannot be null (NOT NULL) and must be greater or equal than one (CHECK numRepetitions >= 1)
- **numSets** cannot be null (NOT NULL) and must be greater or equal than one (CHECK numSets >= 1)

Execution:
- **id** is the primary key (key restriction, PRIMARY KEY)
- **date** cannot be null (NOT NULL)
- **duration** cannot be null (NOT NULL) and must be greater or equal than one minute (CHECK duration >= 1)
- **user** cannot be null (NOT NULL) and is a foreign key (referential integrity, FOREIGN KEY)
- **challenge** cannot be null (NOT NULL) and is a foreign key (referential integrity, FOREIGN KEY)