Projecto de Sistemas de Informação e Bases de Dados

1st Semester 2017/2018

Assignment 1 - Report

ER Modelling and Conversion

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1 Introduction

In this first assignment our project is to manage a health centre population of chronic disease patients using wearable electronic medical devices to monitor health parameters. We will design the database of the medical centre to manage the collected readings and settings of monitored patient devices, together with the medical exams to observe and diagnose their health status, as described in the project statement.

This report includes the ER model diagram, the database conversion code as well as the integrity rules we saw fit to include in the database.

2 ER Model

2.1 ER Diagram

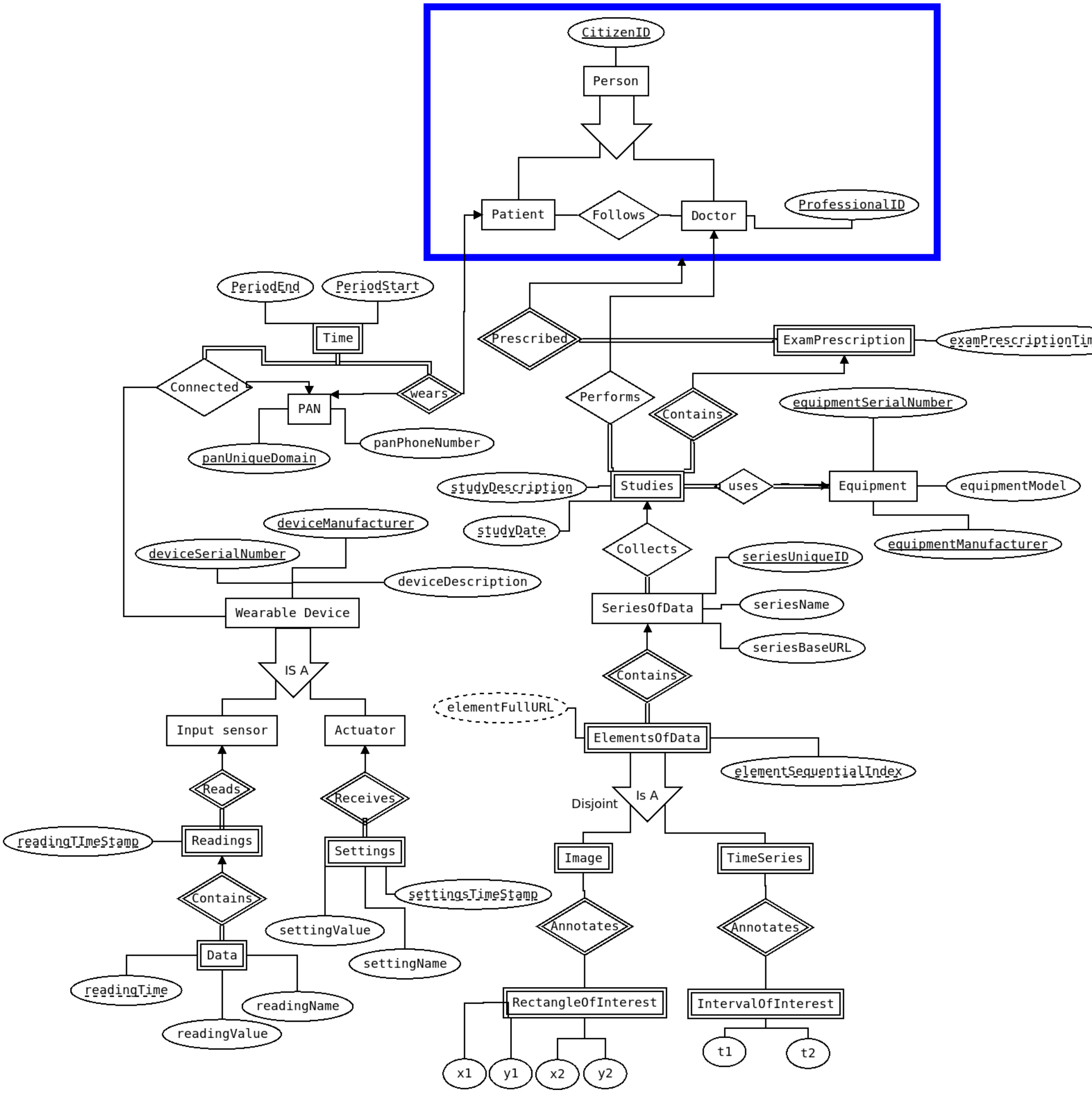

Figure 2.1: ER Model Diagram

2.2 Integrity Rules

Along the ER Model development we encountered some Integrity Rules that are needed to fully implement the database. They are as follows:

- The PeriodStart of entity time must be lower than the PeriodEnd.
- A wearable device cannot be used by two different patients at the same time.
- A wearable device cannot be connected to two PAN's at the same time.
- The exam prescription date for a given exam must be prior to the date of the exam.
- The doctor that preforms a given exam must be different from the doctor that prescribes that exam.
- The URL that references an element of data (timeseries or image) is a concatenation between a base URL that identify the data series and the index of the element you want to refer to.

2.3 Comments

The diagram presented above was conceived by using the database description given in the project statement. The group encountered some difficulties and discussed the best solution to overcome them. One of these solutions was to use a super-entity that involves the 'doctor' and the 'patient' entities, as well as their relationship 'follows', for an exam is always prescribed by a doctor for a patient (there can be no prescription without either). Another solution was to use a derived attribute to the entity 'ElementsOfData' to obtain the URL of said element that is composed by the concatenation between 'seriesBaseURL' and 'elementSequentialIndex' entities.

Studies are made for a certain exam prescription, they cannot exist alone, therefore they are a weak entity of the former.

Both annotations, rectangles and time intervals of interest, are weak entities because they need elements of data keys to be identified.

Since a PAN can be associated with a Patient and with a Wearable Device on a given period, we decided to create two ternary relationships (PAN—MedicalDevices—Period and PAN—Patient—Period) because the period is mandatory in these relationships. Also, knowing that it makes no sense to have a period not associated with the other 3 entities above mentioned, we modeled it as a weak entity.

Due to te fact that Readings and Settings cannot exist by themselves, they are weak entities of their respective wearable devices. Also Data is dependent on Readings to be identified and therefore it's also a weak entity.

3 ER Conversion to tables

STRONG ENITITIES

PAN(PANuniqueDomain, PANphoneNumber);
equipment(equpmentSerialNumber, equipmentManufacturer, equipmentModel);
seriesOfData(seriesUniqueID, seriesName, seriesBaseURL);

IS A's

wearableDevice(deviceSerialNumber, deviceManufacturer, deviceDescription);
inputSensor(deviceSerialNumber, deviceManufacturer)
  serialNumber, manufacturer : FK(wearableDevice);
actuator(deviceSerialNumber, deviceManufacturer)
  deviceSerialNumber, deviceManufacturer : FK(wearableDevice);
person(citizenID);
patient(citizenID)
  citizenID : FK(person);
doctor(professionalID, citizenID)
  citizenID: FK(person);
elementsOfData(seriesUniqueID, elementSequentialIndex)
  seriesUniqueID: FK(seriesOfData);
image(seriesUniqueID, elementSequentialIndex)
  seriesUniqueID: FK(seriesOfData)
  elementSequentialIndex: FK(elementsOfData);
timeSeries(seriesUniqueID, elementSequentialIndex)
  seriesUniqueID: FK(seriesOfData)
  elementSequentialIndex: FK(elementsOfData);

WEAK ENTITIES

readings(deviceSerialNumber, deviceManufacturer, readingTimeStamp)
  deviceSerialNumber, deviceManufacturer: FK(wearableDevice);
data(deviceSerialNumber, deviceManufacturer, readingTimeStamp, readingTime, readingValue, readingName)
  deviceSerialNumber, deviceManufacturer: FK(wearableDevice)
  readingTimeStamp: FK(readings);
settings(deviceSerialNumber, deviceManufacturer,settingsTimeStamp, settingsValue, settingsName)
  deviceSerialNumber, deviceManufacturer: FK(wearableDevice);
examPrescription(citizenID, professionalID, timeStampExam)
  citizenID: FK(patient)
  professionalID: FK(doctor);
studies(citizenID, professionalID, examPrescriptionTimeStamp, studyDescription, studyDate)
  citizenID: FK(patient)
  professionalID: FK(doctor)
  examPrescriptionTimeStamp: FK(examPrescription);
rectanglesOfInterest(seriesUniqueID, elementSequentialIndex, x1, x2, y1, y2)
  seriesUniqueID: FK(seriesOfData)
  elementSequentialIndex: FK(elementsOfData);

intervalOfInterest(seriesUniqueID, elementSequentialIndex, t1, t2)
seriesUniqueID: FK(seriesOfData)
elementSequentialIndex: FK(elementsOfData);
time(citizenID, panUniqueDomain, deviceSerialNumber, deviceManufacturer, PeriodStart, PeriodEnd);
citizenID: FK(seriesOfData)
panUniqueDomain: FK(PAN)
deviceSerialNumber, deviceManufacturer: FK(wearableDevice);

AGGREGATION

INSIDE
follows(citizenID, professionalID);
OUTSIDE
prescribed(citizenID, professionalID, examPrescriptionTimeStamp);

RELATIONSHIPS

connected(deviceSerialNumber, deviceManufacturer, panUniqueDomain);
uses(studyDescription, studyDate, equipmentSerialNumber, equipmentManufacturer);
wears(citizenID, panUniqueDomain, PeriodStart, PeriodEnd);