Check In

Information Architecture Presentation

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Check In Overview

- The affective state of a student can have a significant impact on their performance in a course, as well as their disposition to drop a course.
- ***Check In*** is a web application designed to meet two objectives.
    1) To provide an easy to use interface through which students can register their affective response to each of their course labs.
    2) To provide an Early Warning System which can rapidly flag students at risk to lecturers and tutors based on their responses.
- The software will use a proven affective surveying instrument for computer science students [1] to collect quantitative data. It will also collect written responses which will be analysed by sentiment analysis tools to provide additional quantitative data for analysis, as well as qualitative feedback for the course.
- Lecturers and Tutors will be able to set thresholds for each lab to determine the risk level assigned to students.
- Trends in the students' risk factor can be monitored over time, providing opportunities for targeted intervention by the faculty.

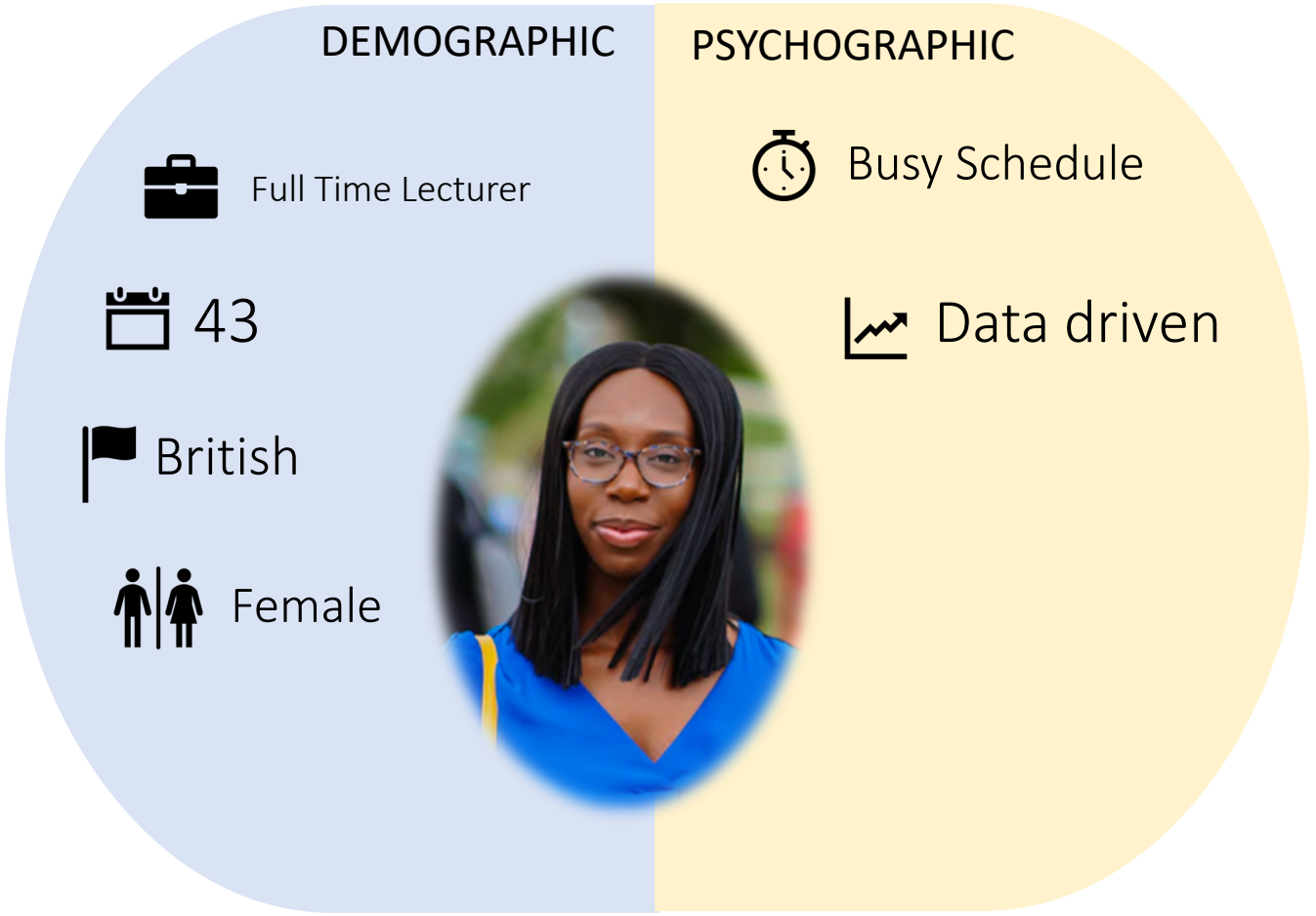
User Personas - 1

Marcella Windsor

Computer Science Lecturer

This is Marcella. Her faculty is under pressure to identify first year students who are at risk of non-progression. She feels that when the students she advises come to her with issues regarding a course, it is normally too late.

Unfortunately, between research and teaching, she finds she does not have enough time to hold advisor meetings as frequently as she would like to know how the students are feeling. Nor does she have time to review the large quantity of data relating to students on her course to identify those at risk. Even when she does, she is frustrated by the lack of qualitative input on the part of the students, and feels she does not have the full picture.



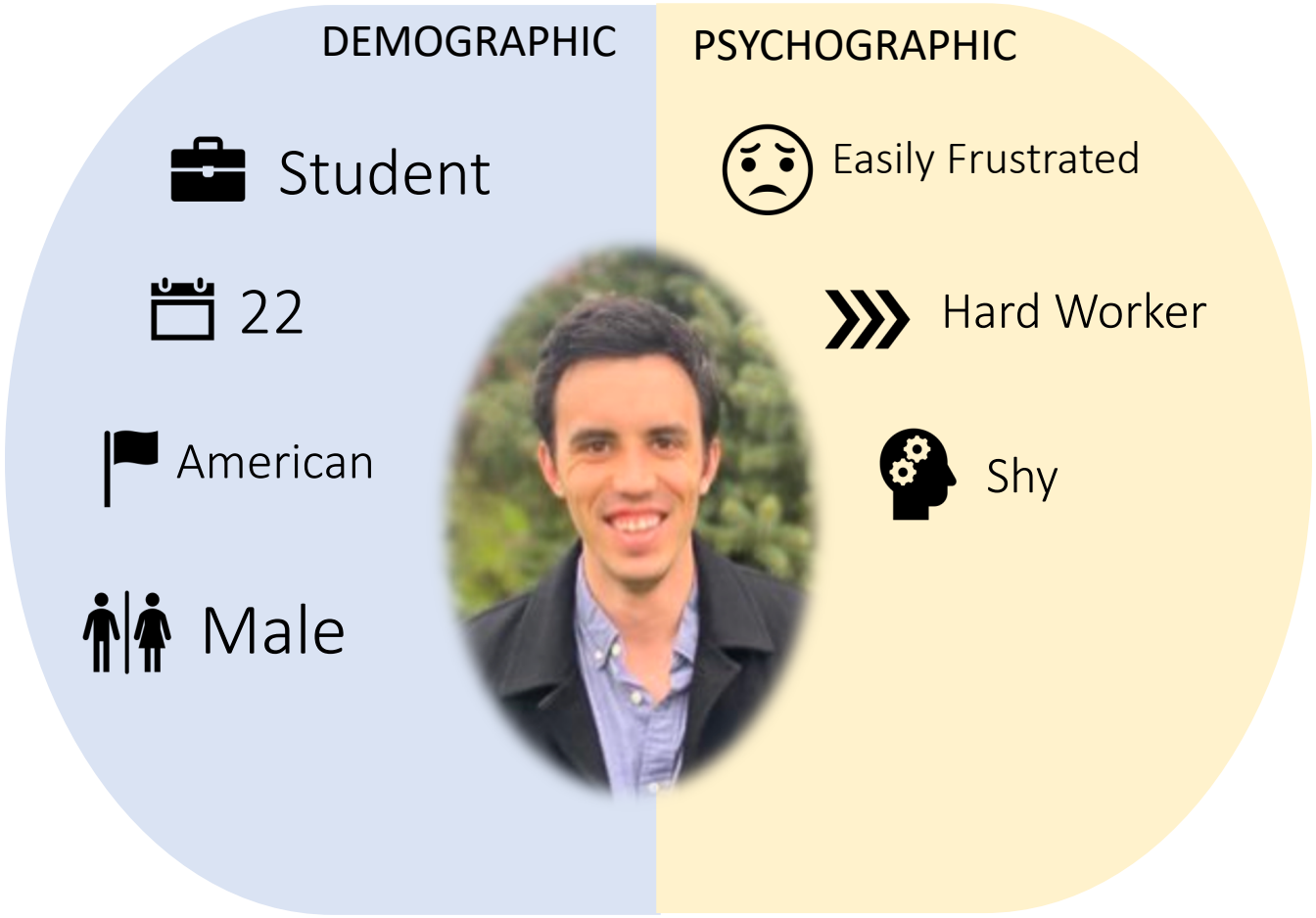
User Personas - 2

Christof Warden

First Year Undergraduate

This is Christof. Christof chose to take computer science because of the promising career it offers. However, he is completely new to programming. He is often frustrated in labs because of the lack of support he perceives from the university. Tutors are too busy and the lecturers feel intimidating and unapproachable. Additionally, half the class seem considerably more experienced than he is.

As a result, he is losing motivation and feels that speaking up would be pointless. However, he would be more than willing to attend extra support sessions if they were smaller and contained others at his level.



User Personas - 4

Sebastian Romero

Computer Science Tutor

This is Sebastian. He is currently assisting in the Database labs on a first year CS course. The labs are very busy and there are 4 tutors between 50 students. Because of the complexity of the tasks, he finds that he needs to spend a reasonable amount of time fielding questions. He is frustrated that he cannot help as many people as he would like to.

Additionally, the bulk of his time is taken up by the same outspoken individuals every week. While he tries to get a sense of how the other students are doing, he finds it very hard to know which students are really in need and senses that quieter students are not coming forward.

Priority: must have | should have | could have | could have

Specification

Functional Requirements

System

- **The system can be populated using existing department data.**

Information about courses, including instructors and students, is often organized by existing university software and stored in a database. Rapidly importing this information would prevent a substantial amount of administration required to populate this system's database.

Survey Instrument

- **Provides XY interface for querying students affective responses.**

Parsons et al's Student Affect Tool [1] demonstrates that this is an effective means of obtaining responses that have greater pedagogical utility than a Likert scale. Thus, it would be an extremely effective feature.

- **Students can enter qualitative feedback on their course.**

Additional qualitative feedback can provide more specific insight into a student's experience, thus assisting with interventions.

- **Qualitative feedback is further analysed by sentiment analysis tools**

Natural language processing can assist in giving a quantitative evaluation of a text as being *negative*, *positive* or *neutral*, along with a confidence percentage. This can assist in classifying students as at risk and can help instructors filter large amounts of qualitative data which would otherwise be too time consuming to consider.

Early Warning System

- **Automatic flagging of students at risk at a regular interval**

The systems core functionality as an Early Warning System is minimize effort in identifying students at risk. As such, survey question responses will have a 'warning' and a 'danger' risk weight (e.g. 3 for danger, 1 for warning). The risk factor for a student in a lab will be:

$$\text{risk factor } \% = \frac{\sum_{i=1}^{n} r_i}{\sum_{i=1}^{n} rmax_i} \times 100$$

$$n = number\ of\ questions\ in\ survey$$
$$r_i = risk\ weight\ for\ ith\ question$$
$$rmax_i = maximum\ possible\ risk\ wieght\ for\ ith\ question$$

. Students who have a risk factor under *X*% for Y consecutive weeks will be flagged as at risk.

- **Danger zones on XY questions are configurable**

A danger zone is an bounded area on the XY grid which indicates an undesirable affective state, e.g. a student feeling they are unable to plan (x value) familiar material (y value). Instructors should be able to manually set the location and weight of such zones depending on the lab, for example, an earlier lab may be more tolerant of unfamiliarity with the material.

Early Warning System (continued)

- **Course thresholds for risk are configurable**

Instructors should be able to adjust the course risk flag threshold (see *X* above *)* and the number of consecutive weeks after which it is triggered (see Y above) and see the according changes to students at risk. This will enable them to cater the EWS to different cohorts as well as to 'hone in' on students most at risk.

- **Instructors can manually flag students at risk**

The tool should be able to assist normal pedagogical practice. If an instructor manually observes a student experiencing difficulty that would otherwise not be detected by the system, they should be able to include them in the system results.

- **Students can flag themselves as at risk**

A student may be experiencing external factors affecting their course performance which are not captured by the tool. They may wish to signal their difficulties to instructors. A simple procedure that takes the pressure off shyer students to initiate a dialogue would be desirable in an EWS.

Dashboard / Visualisations

- **Instructors can see a summary of all student's lab responses.**

A summary of responses would provide feedback at a group level regarding instructions and better enable staff to observe outliers. Additionally, it could be used to inform the setting of XY 'danger' and 'warning' zones mentioned above.

Dashboard / Visualization (continued)

- **Instructors can see an individual students' survey response to a lab. Students can see their own individual responses.**

Being able to see a student's specific responses would allow an instructor to make sense of why the system automatically flagged the student, as well as to provide a focus for intervention. Students should also be able to observe their responses to inform self-regulated learning strategies. For example, helping them target material for review.

- **Instructors can see a summary of an individual student's lab responses over the course. Students can see a summary of their own lab responses over the course.**

As above, but on a macro level. This would allow instructors and students to observe trends in the course to help them regulate their interventions and self-regulated learning strategies accordingly.

- **Instructors can see a summary of all students at risk on a course.**

This is imperative, as this will form a basis of how they target their interventions.

- **Students can see if they have been flagged as at risk.**

Transparency in the system will increase trust between students and faculty. This will also assist the students in reassessing how they allocate their studies (e.g. needing to spend extra time on courses they are struggling with).

- **Users are given a reason for why a student has been flagged.**

System transparency is important, as instructors are disincentivized to use systems which displays opaque, 'black box' signals [2]. Equally, students may experience frustration if they do not understand why they have been identified.

Priority: must have | should have | could have | could have

Specification

Non-Functional Requirements

Usability

- **Students should be able to rapidly access and complete each survey.**

Survey length, timing and mode of access are factors which can affect student response rates [3], and survey fatigue is a consideration.

- **Instructors should be able to determine students at risk rapidly with little cognitive load.**

Due to the time pressures put upon instructors, rapid identification of students at risk is a priority. As such, the process for identifying students should be as simple as possible.

- **Clear instructions are provided to ensure users can understand the tool and its operation.**

Availability

- **Interaction with the tool should not be bound to a specific time or location.**

Labs may take place in different parts of the university, so the survey instrument cannot be tied to specific workstations. Additionally, users may want to analyze their respective dashboards at a time and location which suits them.

Priority: must have should have could have could have

Specification

Non-Functional Requirements

Extensibility

- **The system should be extendable to other courses and schools.**

Teaching interventions based on affective responses to classes and labs is not a concept limited to CS1. Therefore, the system architecture should allow the tool to be easily modified for other contexts.

- **The architecture should support experimentation with the survey format.**

Given the novelty of the XY and sentiment analysis approach, further research and evaluation may be required to determine the optimum survey configuration for a varying contexts.

Privacy and Compliance

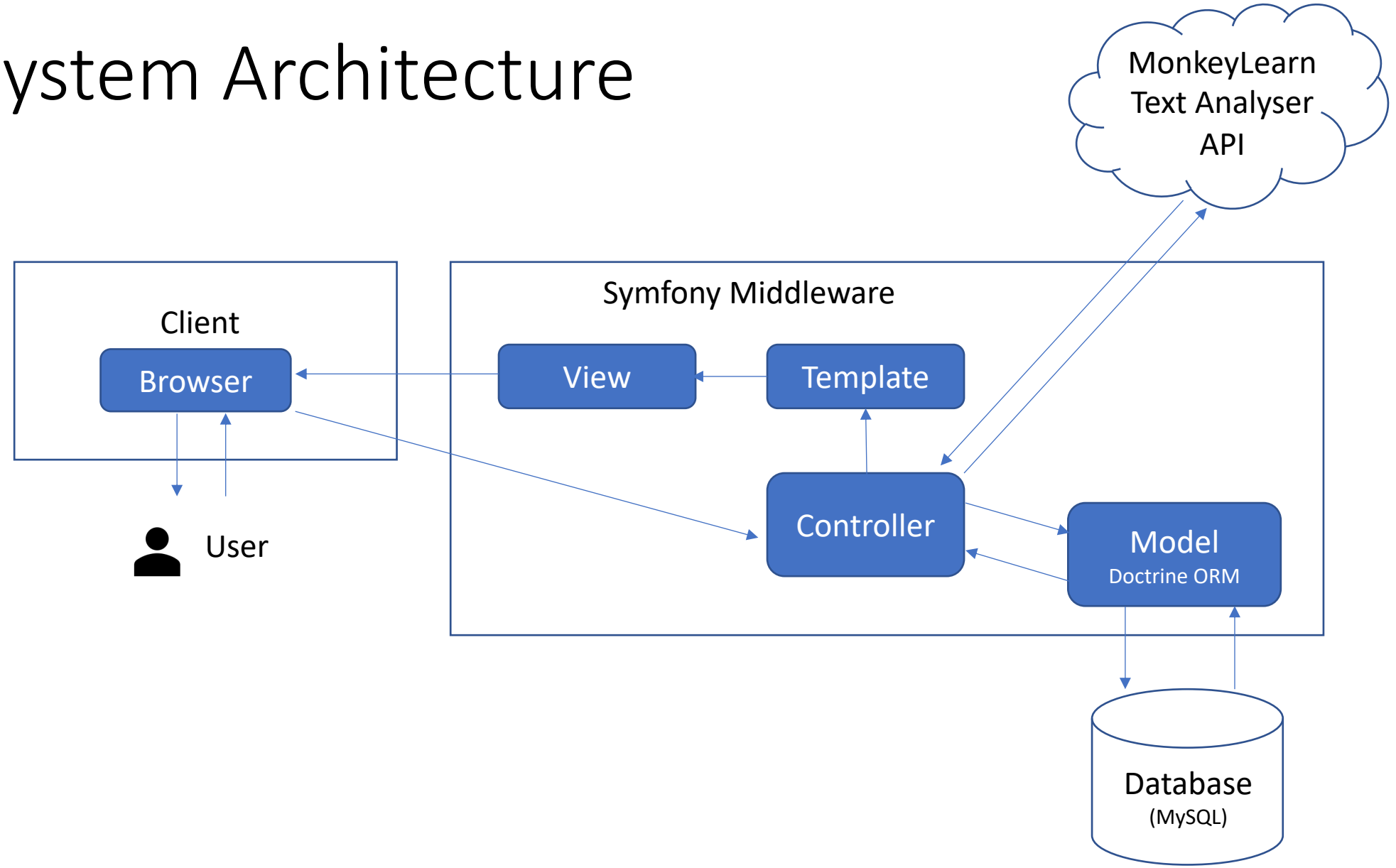
- **Students and Instructors have access only to information which pertains to their role**

Due to the sensitive nature of the survey responses, it is imperative that data is only shared to those to whom it pertains. For example, an instructor should only be able to view survey data given by students they teach, or a student should not be able to access information beyond their own.

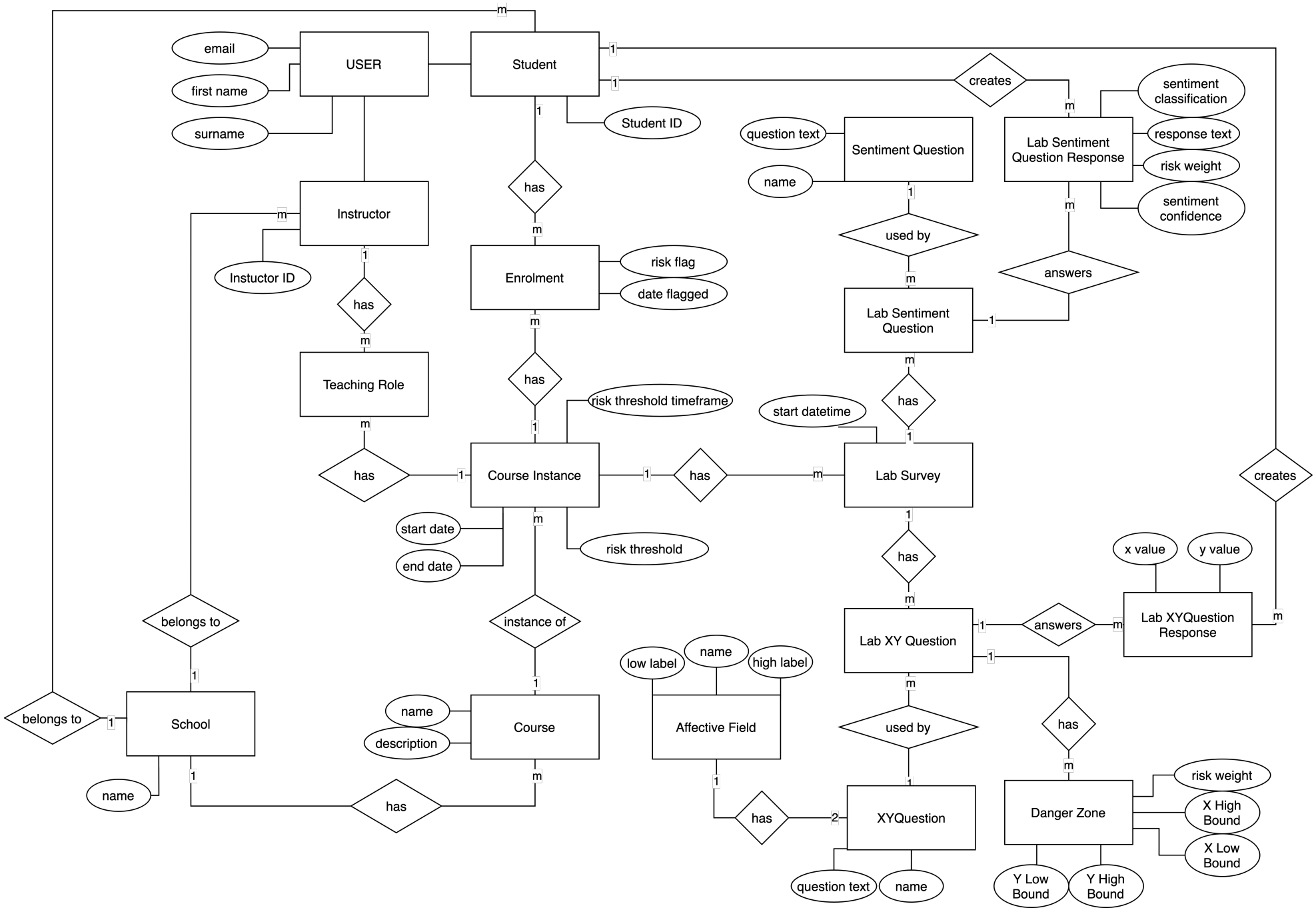
- **The production application is GDPR compliant and issues a compliance notice to students on login**

The initial prototype is not expected to be production ready, but a detailed notice which outlines how data is captured, used and protected in the software is essential to building user trust as well as meeting regulatory compliance. Should the software reach production stage, this will be included.

System Architecture



ER Diagram


email
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Teaching Role
risk threshold timeframe
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Course Instance
start date
end date
risk threshold
Lab Survey
creates
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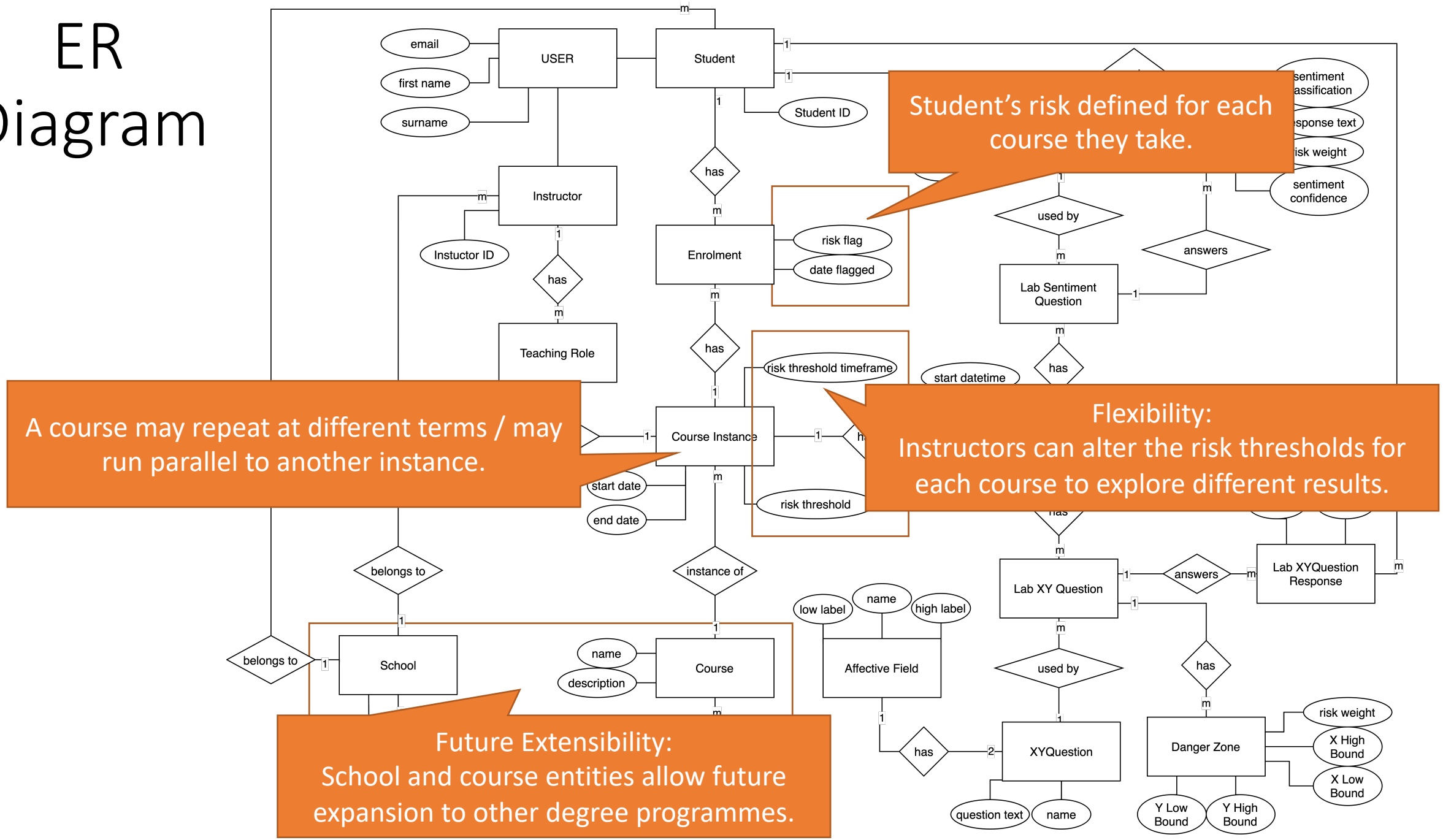
School
name
Course
name
description
low label
high label
Affective Field
Lab XY Question
x value
y value
Lab XYQuestion Response
XYQuestion
question text
name
Danger Zone
risk weight
X High Bound
X Low Bound
Y Low Bound
Y High Bound

ER Diagram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X Low Bound
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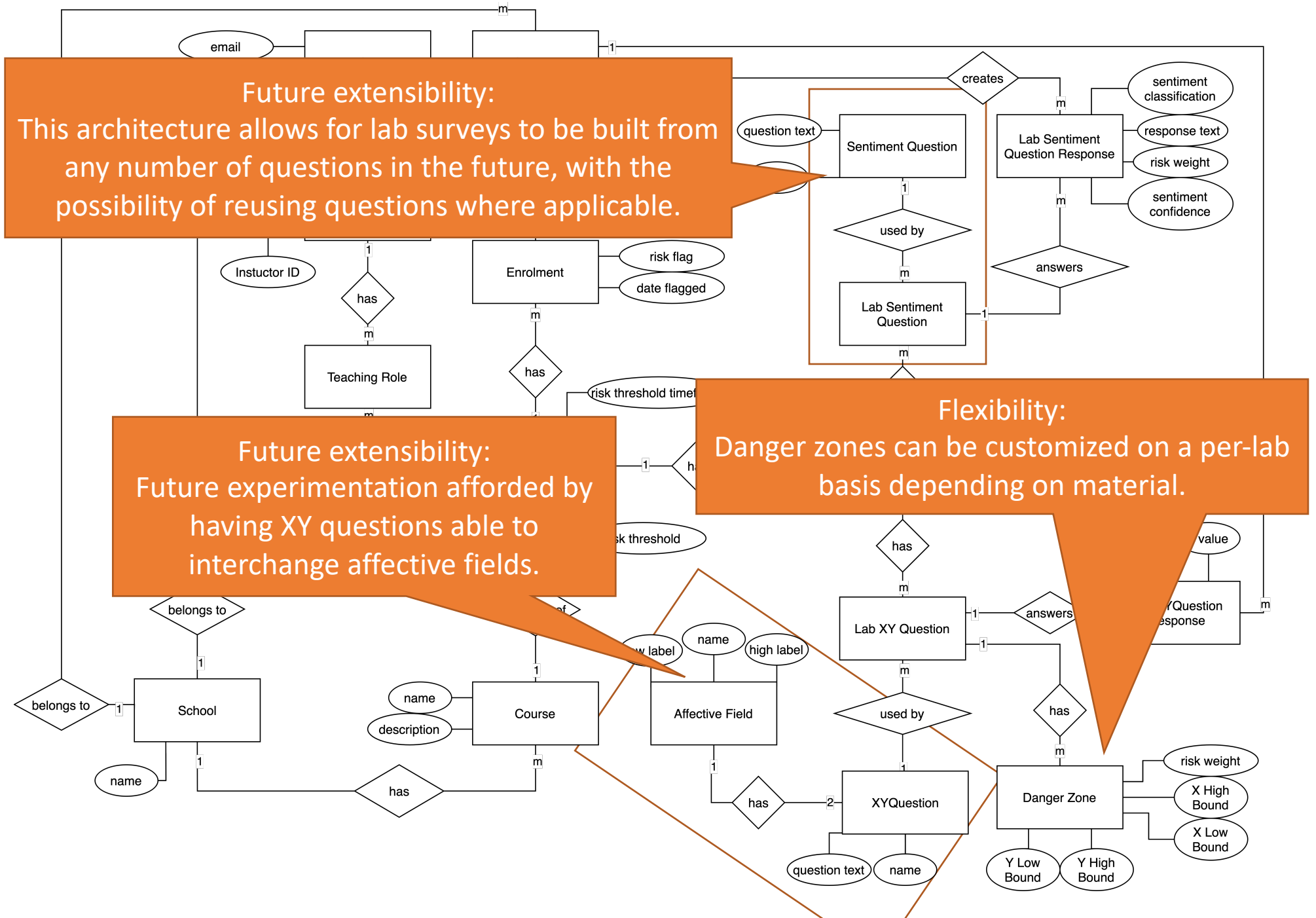
Student's risk defined for each course they take.
A course may repeat at different terms / may run parallel to another instance.
Flexibility:
Instructors can alter the risk thresholds for each course to explore different results.
Future Extensibility:
School and course entities allow future expansion to other degree programmes.

ER Diagram


Future extensibility:
This architecture allows for lab surveys to be built from any number of questions in the future, with the possibility of reusing questions where applicable.
Future extensibility:
Future experimentation afforded by having XY questions able to interchange affective fields.
Flexibility:
Danger zones can be customized on a per-lab basis depending on material.
email
Instuctor ID
has
Teaching Role
Enrolment
risk flag
date flagged
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creates
question text
Sentiment Question
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Lab Sentiment Question
Lab Sentiment Question Response
sentiment classification
response text
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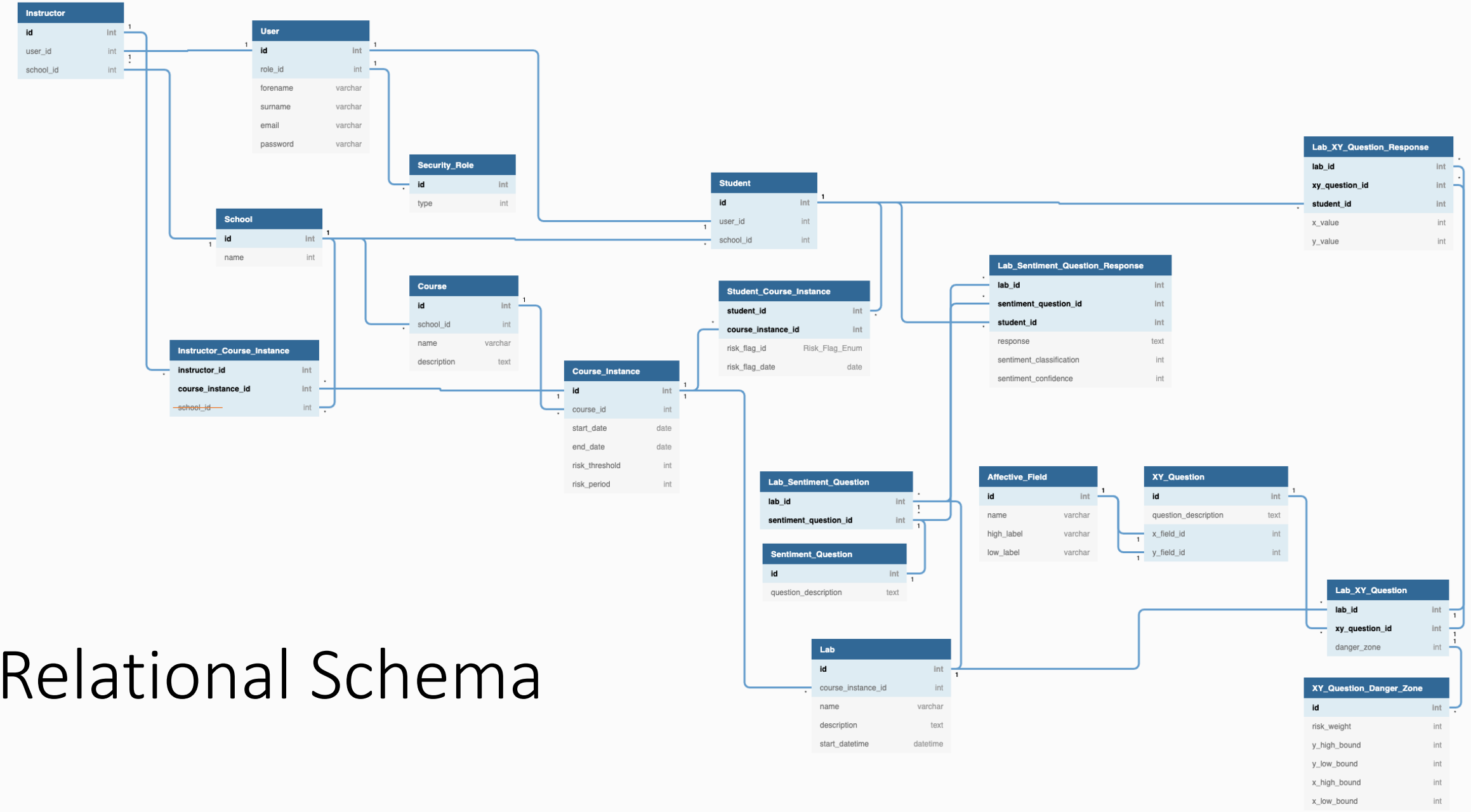
X Low Bound
Danger Zone
Y Low Bound
Y High Bound

Relational Schema



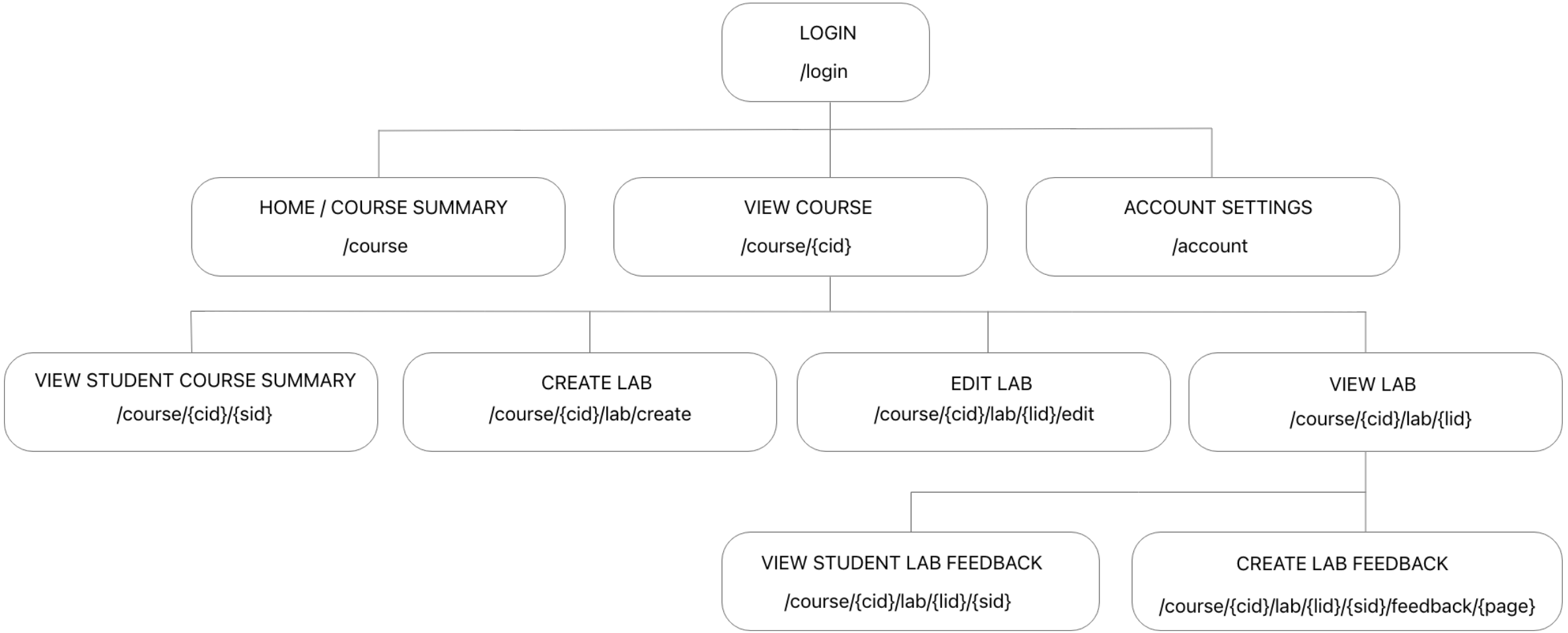
dbdiagram.io

Prototype Walkthrough

Interactive wireframe prototypes are available online:

- Instructor
- Student

Sitemap


LOGIN
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EDIT LAB
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VIEW LAB
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VIEW STUDENT LAB FEEDBACK
/course/{cid}/lab/{lid}/{sid}
CREATE LAB FEEDBACK
/course/{cid}/lab/{lid}/{sid}/feedback/{page}

References

[1] P. Haden, D. Parsons, J. Gasson, and K. Wood, “Student affect in CS1: Insights from an easy data collection tool,” in *ACM International Conference Proceeding Series*, Nov. 2017, pp. 40–49, doi: 10.1145/3141880.3141881.

[2] M. Brown, “Seeing students at scale: how faculty in large lecture courses act upon learning analytics dashboard data,” *Teach. High. Educ.*, vol. 25, no. 4, pp. 384–400, May 2020, doi: 10.1080/13562517.2019.1698540.

[3] M. Shah, C. S. Nair, and J. T. E. Richardson, “Engaging Students and Staff in Feedback and Optimising Response Rates,” *Meas. Enhancing Student Exp.*, pp. 47–58, 2017, doi: 10.1016/b978-0-08-100920-8.00005-8.