CSCE 3701 - Software Engineering
Dr. Sherif Aly
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Final Milestone

Self-Check and Mask Wearing Detection

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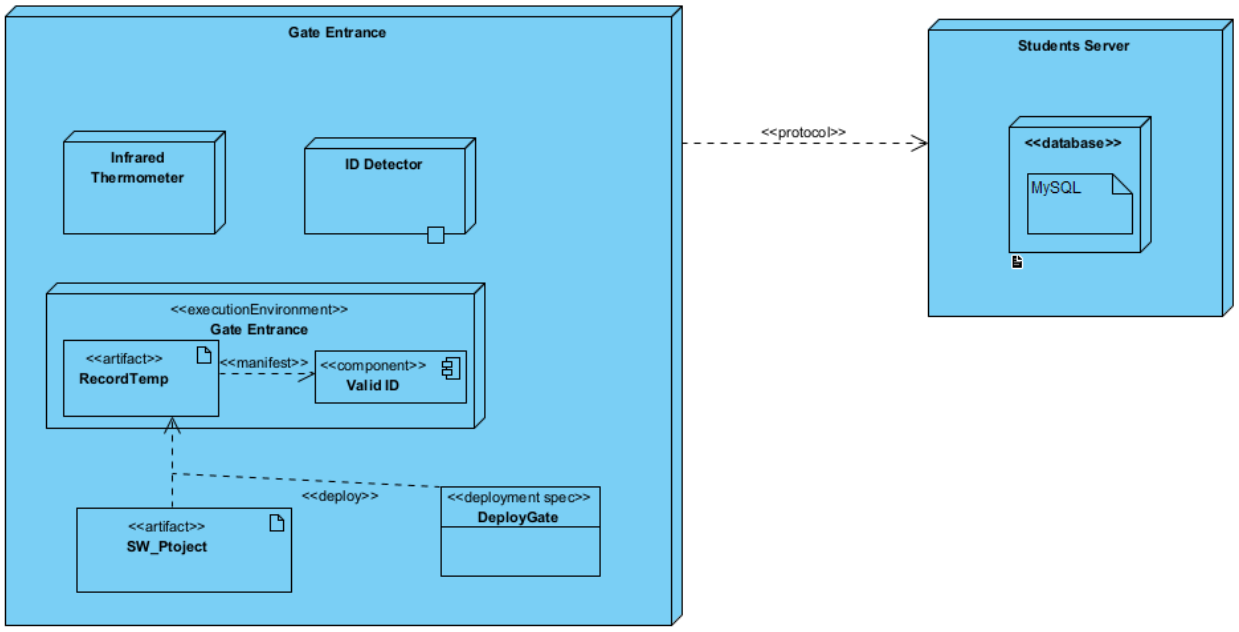
Overview of The System:

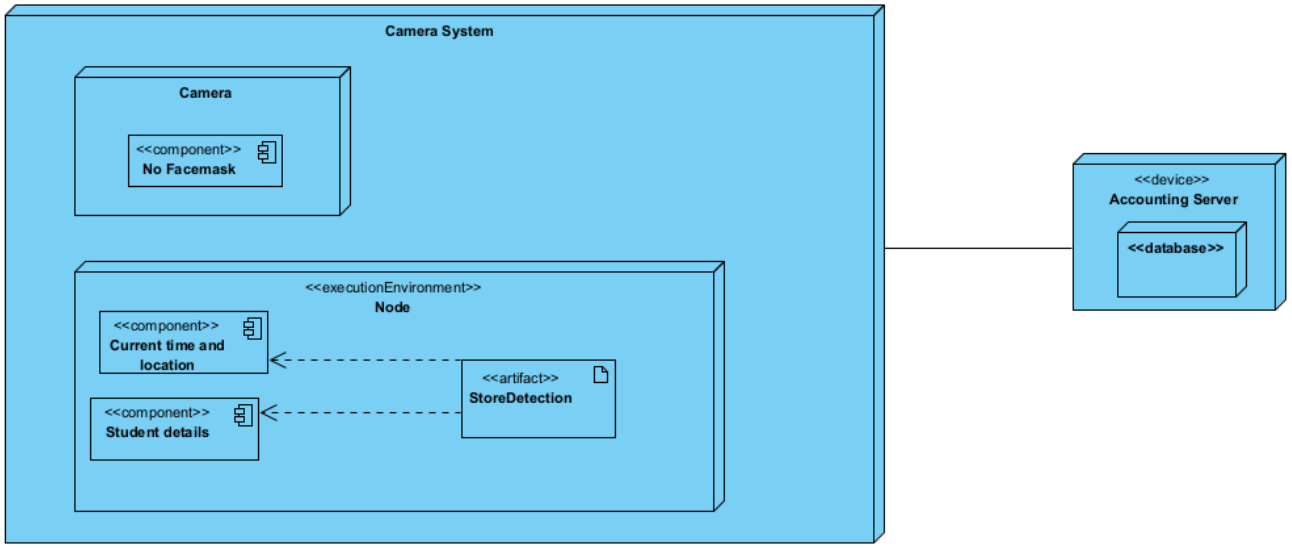
The return back to on-campus lectures has been a challenge for most students in the AUC. The students are facing difficulties to follow the covid related regulations imposed by the university. One of the difficulties include wearing the face mask around the campus at all times to minimize the spreading of the virus that may lead to online learning again. In addition, the students are slowed down in entering the campus because of the daily self-check imposed by the university on all students to access the campus. The software system we want to implement uses the cameras installed all over the campus to monitor the students not wearing face masks. The software would be an extension on the AUC banner app and website that would show every student his status. The camera will detect if a student is not wearing a face mask and will impose a fine on that student. The first detection will send a warning to the student and later on actual fines will be imposed. The software will show the students captures from the camera when the student was detected for evidence. Every student has the right to file a complaint that he or she was falsely fined and using the app the students can file a complaint and the fine will be removed. On the other hand, when a student finishes a whole week with a perfect record, a reward will be sent to him for example as a voucher for a food outlet on campus. In addition, temperature monitoring devices will be installed on each gate to record the temperature of the students and to store it daily for each student in his app. Moreover, the app will have a feature that allows students to book an antigen test in advance with the option of specifying the covid case the student was in contact with to receive a free antigen test before accessing the campus. The antigen test booking feature will disregard the need of the daily self-check as any student or faculty member that was in contact with a covid case can simply book an antigen test before accessing the campus. Moreover, the thermometer at the gates will be faster for the security guards than the self-check. In general, when accessing the extension in the app, the student may view the records of his temperature and his mask wearing detection also to redeem his rewards if applicable.

System Architecture:

1. Physical View:

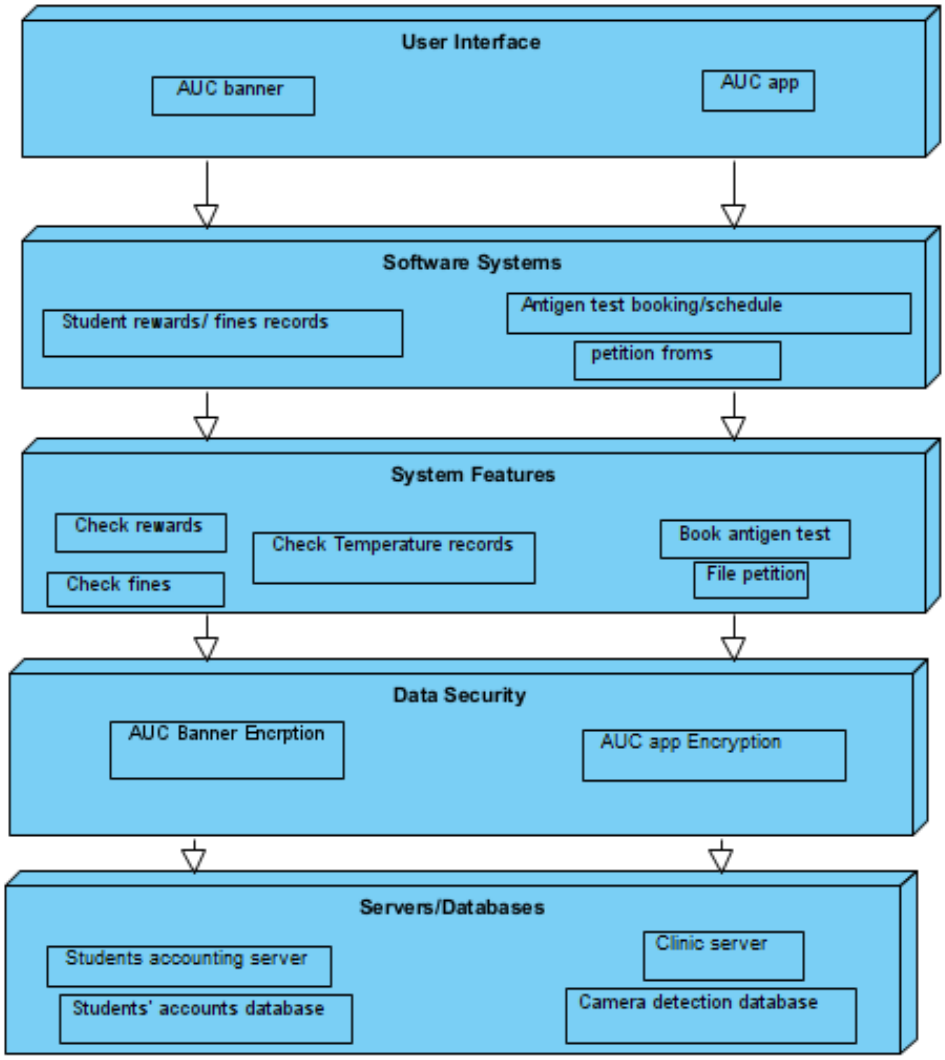


This is the deployment diagram of the system that will be implemented on the gate. It will feature hardware devices, the “infrared thermometer” and the “ID detector” which is already installed on our gates. The gates will use the artifact RecordTemp to record the measured temperature of students using their ID and store it in the database. The whole system will work using our system or potential software “SW_Project”. The data will be stored in the database using the Students server developed using MySQL which we developed last sprints.

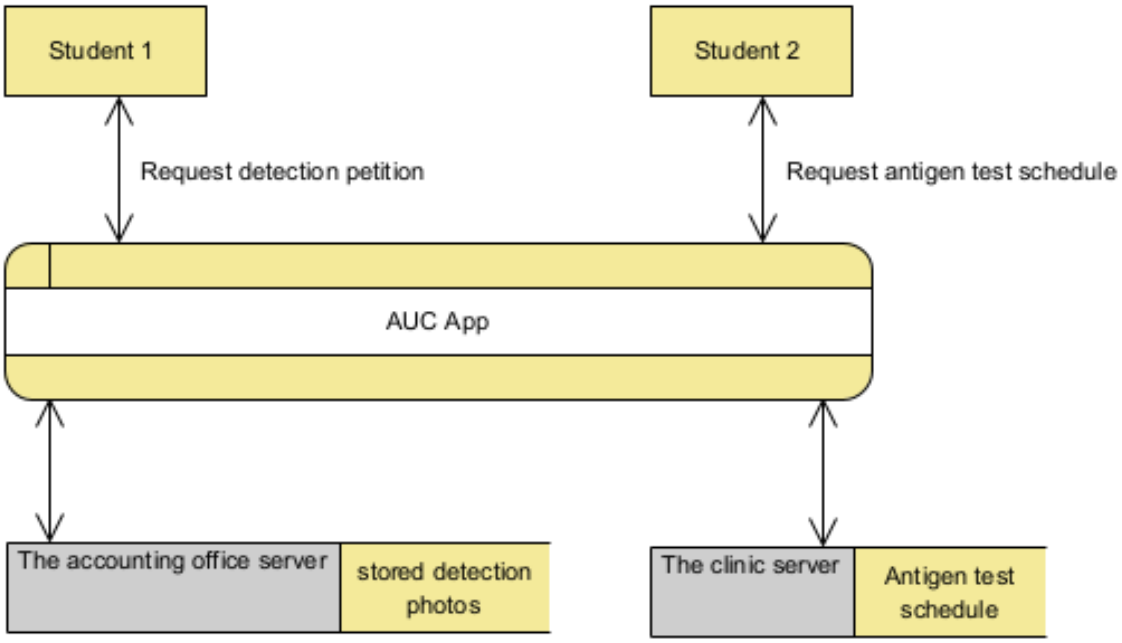


The second diagram is for the Camera detection system. The Camera is used when a student wears no facemask. The camera records the time and location and the details of the students and then sends the details to the database of the accounting department to add the fine on the students account.

2. Logic View



The 5 layers of the layered architecture of our system are divided as follows. The first top layer is the two User interfaces which are the AUC app and Banner. The user has three systems to choose from the system (in the second layer)that we will implement on the two user interfaces which are , to book an antigen test,to file a petition form and access fines and rewards. The third layer is the features in the three systems as featured in the diagram. So the fourth layer is dedicated for the security of the data of the students so the data going to and from the database is encrypted. The final layer is for the servers and databases in our system. Each layer has only access to the adjacent layers.



This is the Client-Server architecture for the AUC app system extension. The two possible requests are the antigen test schedule and to request to file a petition. The AUC app then accesses the server of the clinic and the accounting office to obtain the data from the databases to provide for the client.

Infrared Thermometer:

The infrared thermometers will be installed at every gate. The thermometer will sync the temperature with the ID detector at the gate and will save the temperature automatically to the person who checked in using his or her ID after the temperature measurement.

Face detecting camera:

The face detection cameras may be substituted with the cameras already installed on campus or even in more areas to cover larger areas

Servers:

The servers will be installed to cover the larger access on the AUC app and AUC banner as more options and features will be added on the app. The extra servers will help minimize the crashes in the system and will allow the system to run smoothly.

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Diagrams:

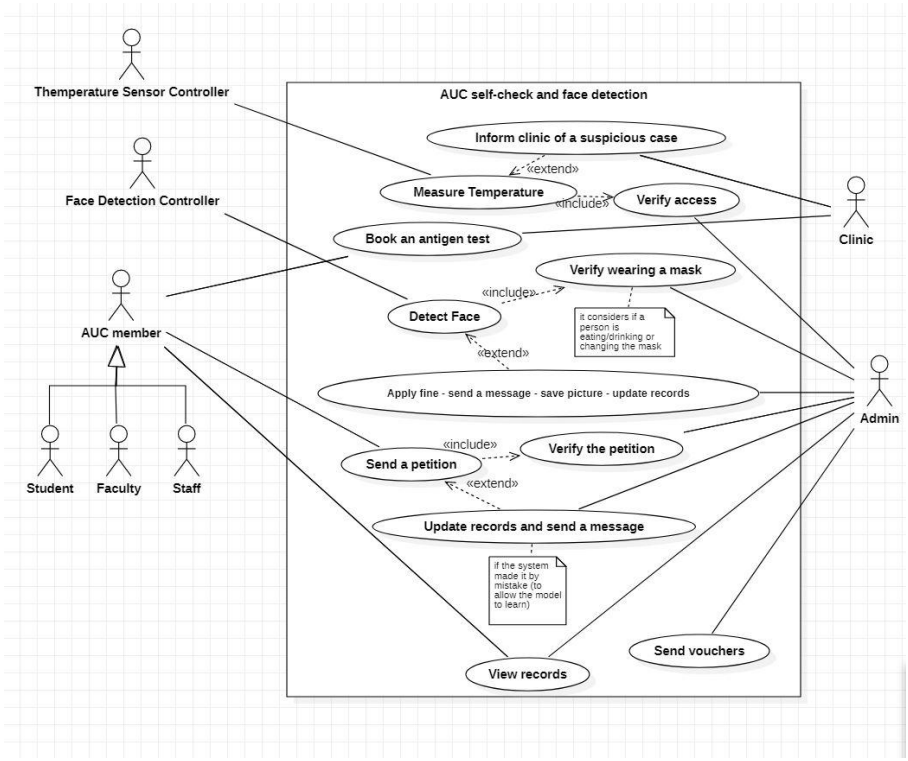
The diagrams represent how the system will be functioning as follows:

· The temperature sensor controller is the part responsible for measuring the temperature of AUC members when entering the gate, then depending on the temperature, it takes a decision. If it was verified to be in the acceptable range, it will allow access to campus. Otherwise, it will inform the clinic of that person as a suspicious case.

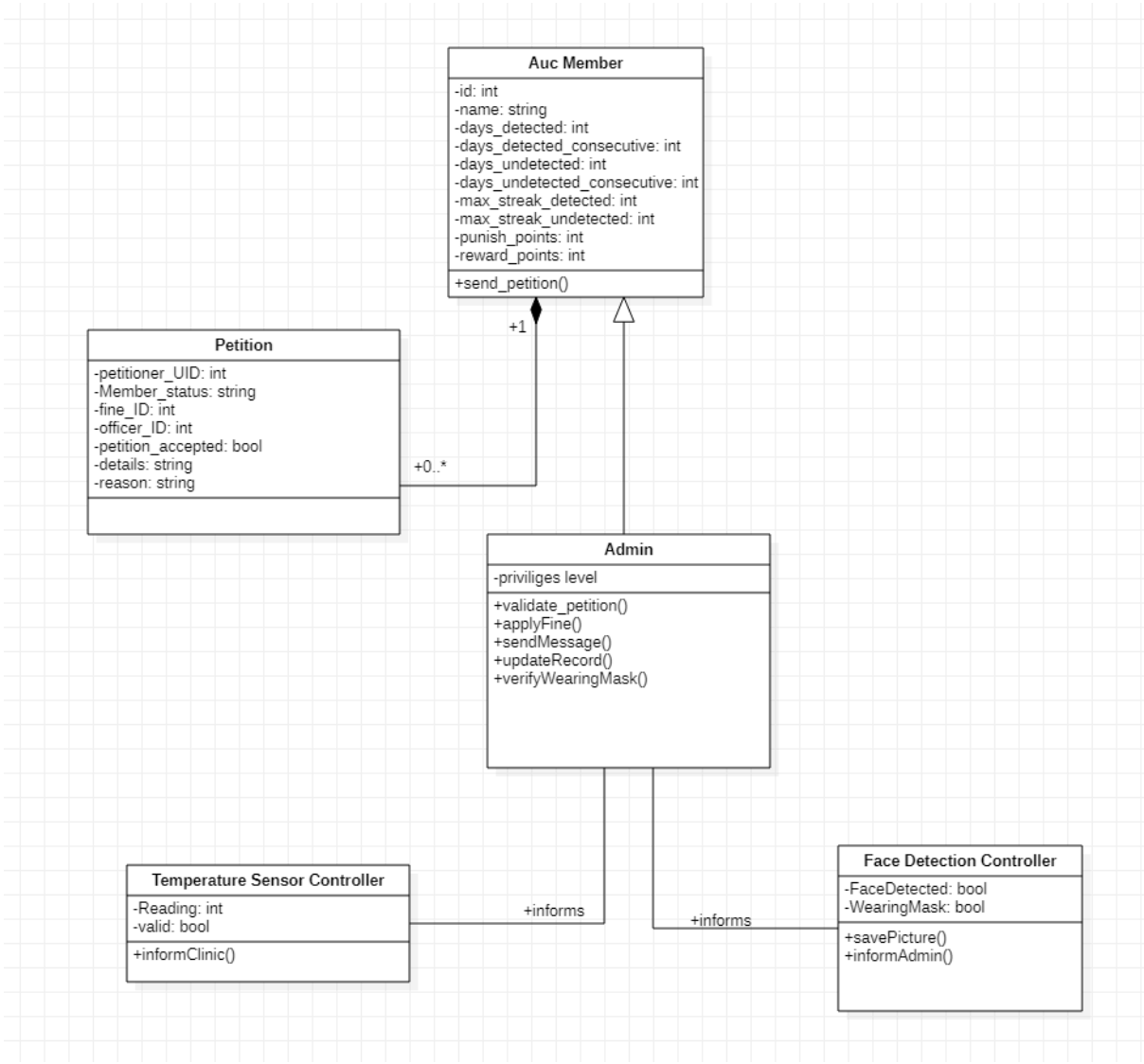
· The face detection controller detects faces all the time, and a verification for wearing a face mask is done. If a person who is not eating, drinking, or changing their mask was detected without wearing a mask, then the admin will apply a fine on that person, send a message on the application notifying them that a fine was applied, document the picture, and update the records for further considerations, such as intensifying the punishment in case of repetition. The person will be matched with the picture using the photo of their ID, and if needed for training the face detection model, students may be required to submit photos for themselves.

· AUC members can send petitions if they think the fine was applied mistakenly, and in that case, the admin will recheck the record and the picture. If it was a False Negative result, meaning the model classified the photo as a person not wearing a mask incorrectly, then the admin will update the records by removing the fine and notify the person of that update.

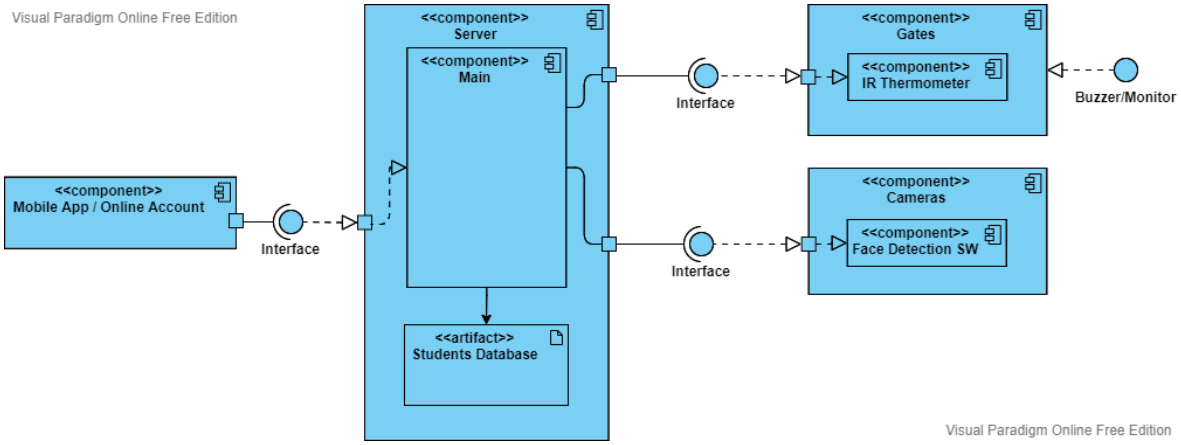
Use Case Diagram



Class Diagram

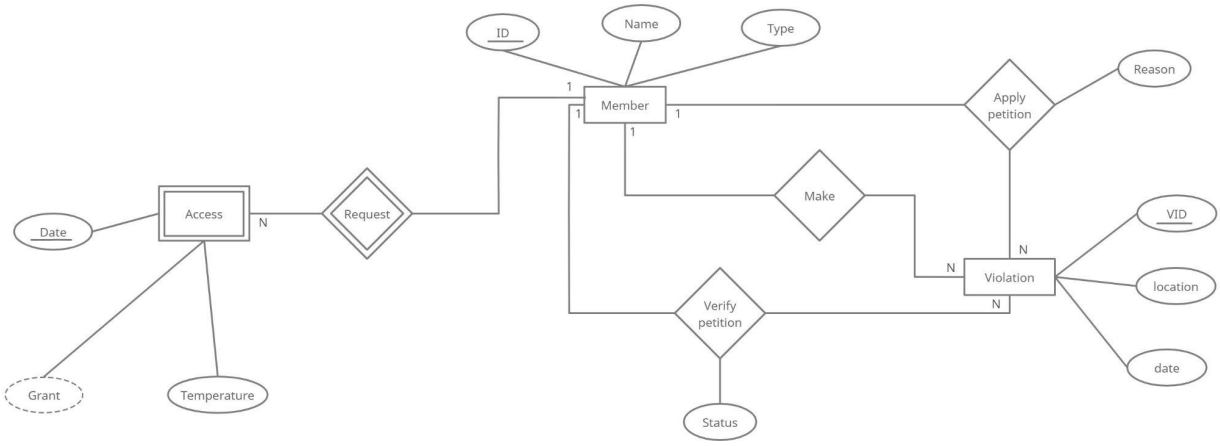


Component Diagram:



For the database, an Entity Relationship Diagram (ERD) and Relational Model were used.

ERD:



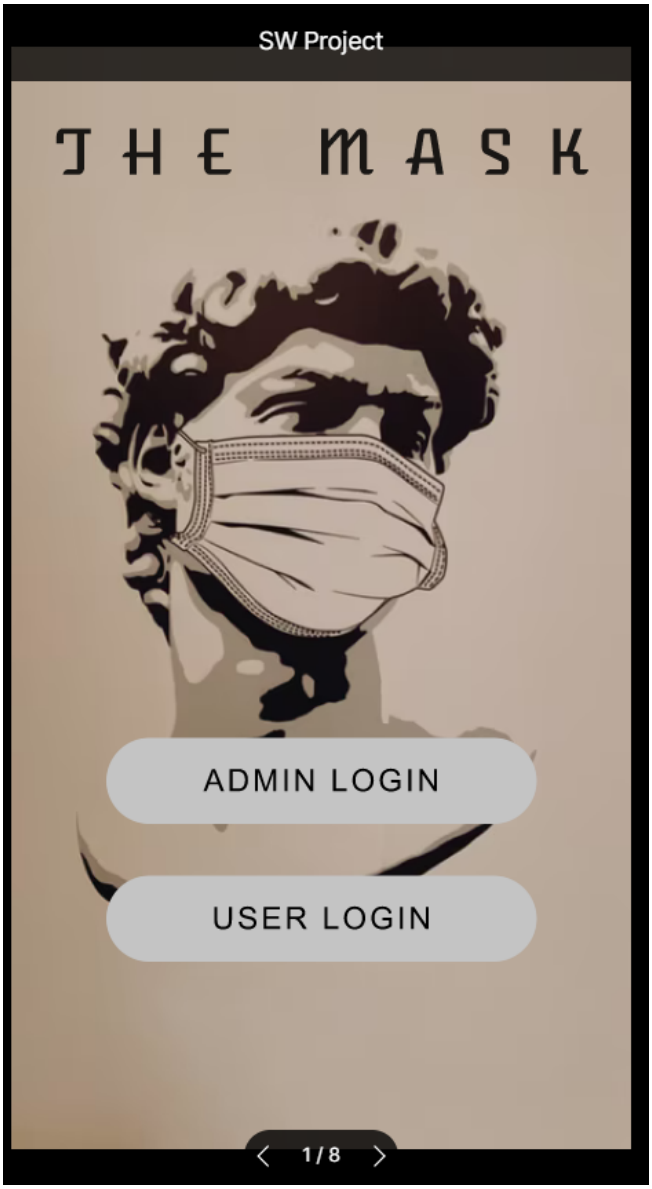
Relational Model:

```
Member(ID-PK, Name, Type)
Violation(VID-PK, location, date, ID_Make-FK)
Petition_Violation((ID_Petition-FK, VID-FK)-PK, Reason)
Verify_Petition((ID_Verify-FK, VID-FK)-PK, Status)
AccessRequest(ID-PK, Date-PK, Temperature, Grant_Access)
```

Future Expansion:

For the future, we would like to cooperate with the AUC board to implement our system and project on campus. To be precise, we want to offer our system to the AUC board and use the resources we have available on campus to further develop our system. The development of our system will be that we use the security cameras installed all over campus and develop an embedded system that functions like our project to detect all the students not wearing a face mask. Moreover, we may install the infrared thermometer at the gates to measure the temperature of the students as they enter from the gate. An extension will be applied to the AUC app to allow students who were in contact with any COVID-19 case or feel any symptoms to book an antigen test (just like our C++ code) rather than making the self check daily. Finally, we will also apply an extension to the AUC banner so students can track their status concerning the rewards/fines applied to their account from the face mask detection across the campus. We will list below the hardware devices that we will need to implement our project on campus and their uses.

Prototype and code:
Prototype:
https://www.figma.com/proto/6Lu4cUPraIfGgyszQRDmNv/SW-Project?page-id=0%3A1&node-id=168%3A59&scaling=min-zoom&starting-point-node-id=168%3A59



MySQL code for creating the database
https://github.com/Abdelbaset65/CSCE3701_Project
https://github.com/Abdelbaset65/CSCE3701_Project/blob/main/Database%20Code.sql
Demos
https://drive.google.com/drive/folders/1n-NIqQYN1ZBJU47vD46d9ATlu0ewG8su?usp=sharing