



Engineering
& Computing

School of Computing
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School of Computing & Information Sciences

Fall 2023 Capstone II Project



FIU IoTConnect

Students: Michael A. Simon

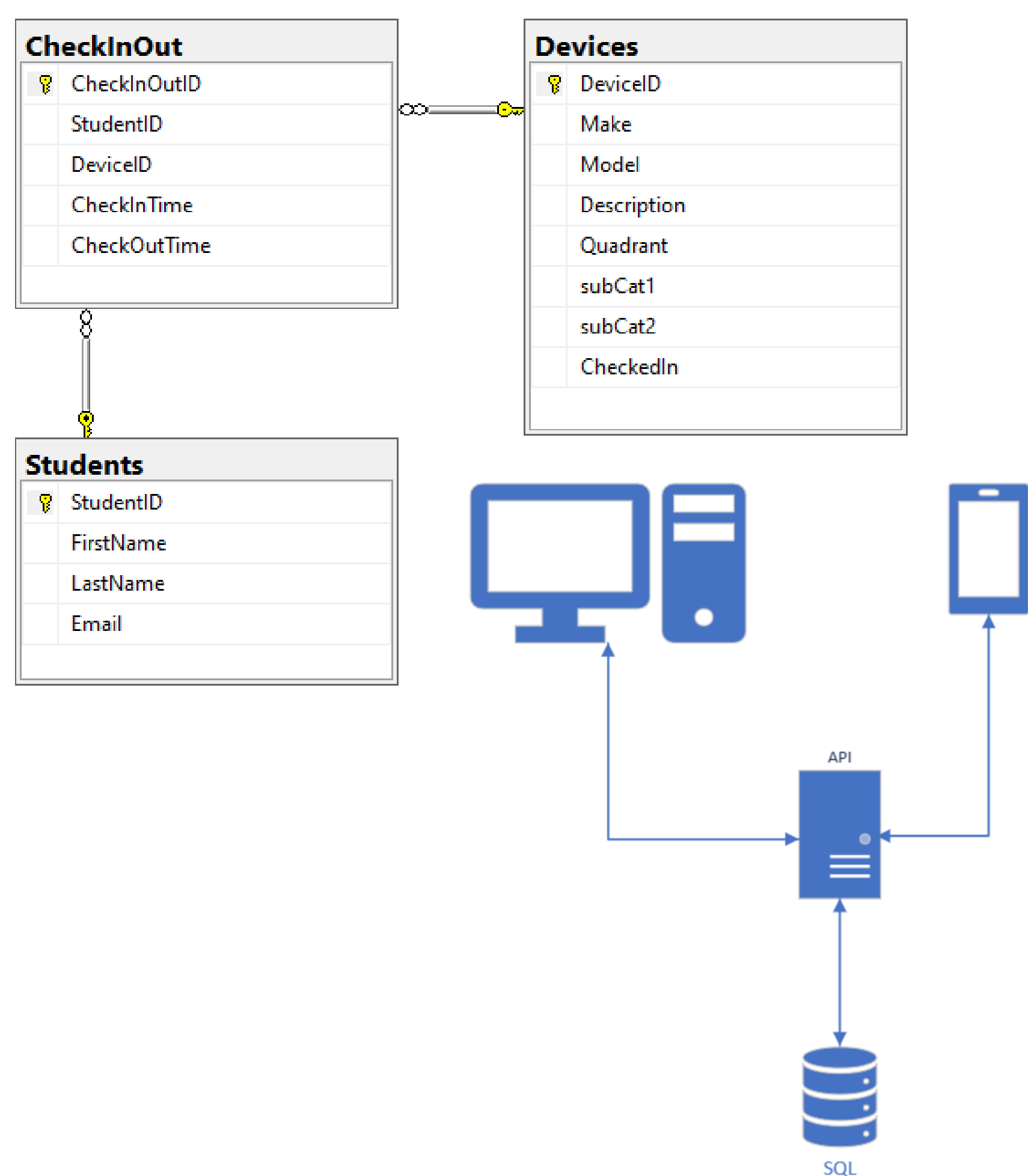
Mentor: Selcuk Uluagac

Instructor: Dr. Masoud Sadjadi, Florida International University

Problem

The creation of the Cyber-Physical Systems Security Lab under the Electrical and Computer Engineering Department at FIU, spearheaded by Professor Selcuk Uluagac, has been a significant milestone for the institution. This specialized lab has amassed a considerable collection of smart devices over time, becoming an invaluable resource for both students and research associates. The maintenance and inventory tracking of these devices initially relied on their direct involvement. However, this hands-on approach has given way to the use of basic, less secure methods, such as manually updated Excel spreadsheets. While functional, these methods are not without drawbacks, primarily concerning the security of the data and the accuracy of the inventory records. These issues have understandably led to considerable difficulties in managing an accurate and reliable inventory, indicating a clear need for a more sophisticated and secure solution.

System Design



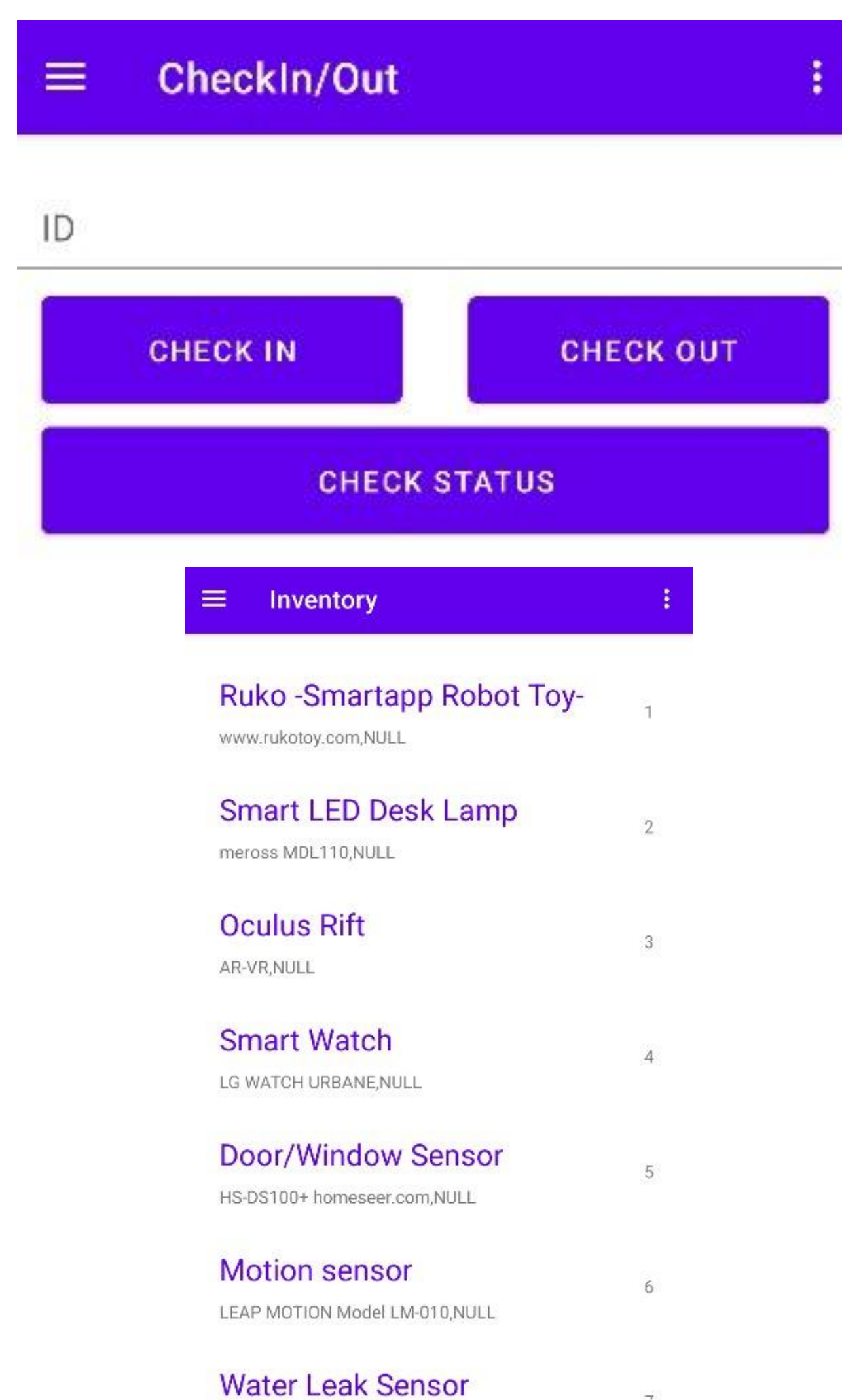
Individual Contributions

During the course of this project, my individual contributions were substantial, encompassing a diverse range of critical tasks and responsibilities that formed the backbone of the Inventory Management System. I was responsible for designing the API backend, ensuring efficient communication with the SQL server to guard against vulnerabilities such as SQL Injection Attacks. I was also in charge of diligently managing the SQL Server to ensure a seamless inventory management experience. In the realm of mobile application development, I dedicated my efforts to crafting an intuitive Android application, harnessing the capabilities of Java and Android Studio to deliver a product that significantly enhances user engagement and operational efficiency. My contribution reflects a deep commitment to technical excellence and a thorough understanding of the tools and technologies that underpin our innovative Inventory Management System.

Project Overview

The objective of our project was to conceive and develop a comprehensive Inventory Management System tailored specifically for the Cyber-Physical Systems Security Lab. Our vision was to facilitate an efficient, user-friendly application that would serve as the nucleus for managing the lab's extensive array of smart devices. The scope of the project encompassed the integration of API backends, the utilization of SQL for database management, the crafting of intuitive website frontends, and the innovation of mobile applications. Utilizing the versatility and collaborative potential of open-source technologies, this projects requires us to forge a robust, secure, and accessible platform. While also adhering to industry-accepted standards and practices throughout the development process, ensuring that our system would not only meet but exceed the expectations for security, reliability, and ease of use within an academic research environment.

System Results



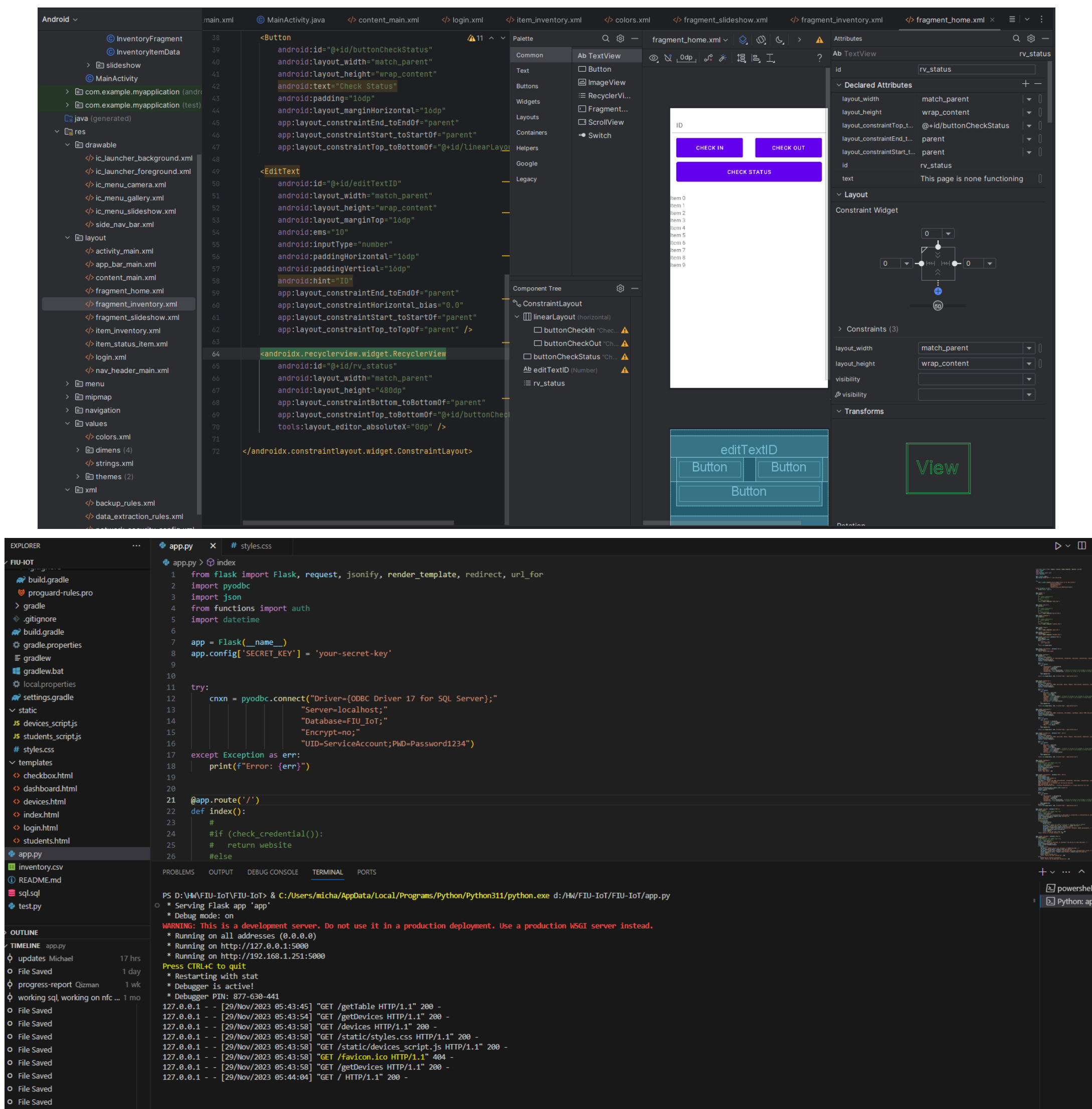
Tools Used

To architect our Inventory Management System, we selected Python, renowned for its security and efficiency, to construct the web framework and API that facilitate secure communication with the Microsoft SQL server, thereby preventing SQL Injection Attacks with the help of Flask—a web framework lauded for its simplicity and robustness. Our backend interactions are powered by Python's Pyodbc library, interfacing with the server via ODBC 18 Drivers for dependable communication, while Microsoft SQL Server, managed with SQL Server Management Studio (SSMS), underpins our inventory database. On the mobile front, we've developed an Android application using Java and Android Studio, which enables streamlined, on-the-fly inventory management for our users.

Implementation



Screenshots



Summary

Our project successfully developed an initial prototype for the Cyber-Physical Systems Security Lab's Inventory Management System, featuring a Python-based API backend, a structured SQL server, and a mobile application for Android. While this prototype encompasses most of the desired functionalities, future enhancements are planned. Key additions include integrating NFC scanning for improved user interaction and implementing SSL encryption, using either an FIU certificate or a PKI self-signed certificate, to bolster system security. These upgrades aim to refine and secure the system further.

Acknowledgement

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