CS 411 Lab II

Product Specification

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1 **Introduction**

      Young underprivileged students are adversely affected by having to learn online because of a lack of stable high-speed Internet and because they lack the knowledge and support at home needed to adapt when the Internet fails. School systems were forced to adapt to new styles of teaching due to the COVID pandemic starting around April of 2020. While colleges have been using resources for online learning for decades, grade schools are not so fortunate. The shift in teaching style is affecting students' ability to learn. Younger students are struggling the most with the shift to virtual or hybrid learning. If the student encounters a technical problem, there is not much they can do about it. The student will likely ask their parents, who might lack the troubleshooting knowledge to fix the problem. The next course of action is to contact the teacher, who, like the parent, likely lacks the skills necessary to deal with a technical issue. The other half of the problem is the lack of stable, high-speed internet access at home for lower income families. Roughly 40% of students from low-income homes must complete their homework on public internet connections. These connections tend to have slow connections when many people are on at one time, and frequently there is a time limit as well. A young student relies on their parents or a guardian to take them to public places, which might not always be possible. The solution is a student facing app and a teacher/admin app called Inclusive Classroom. The student view will have a simple UI that is designed for children. It will be a native app so that it can run without needing internet access. The student software will have a high level of automation, such as uploading and downloading files, and zipping and unzipping files to make things as straightforward for the student as possible. The teacher view will not need to be constrained to a certain device since a teacher will likely have good internet access at work. Teachers will be able to log in on any device via login and password. The teacher interface will be designed with convention over configuration in mind to keep things simple for the student.

1.1 Purpose

The primary goal of Inclusive Classroom is to increase the accessibility of online learning to low-income students. The solution is a two-pronged approach. The two primary sections will be the student-side flow and the teacher-side flow. The student side will have the ability to passively download and upload, both assignments and lectures. There will be a timestamp attached to completed assignments to enable teachers to determine whether an assignment has been completed on time. The major goal of the teacher-side flow will be to allow the teacher to interact with these students with as little headache as possible. This will be done by automating processes for uploading lectures and sending notifications of live stream status to students. The teacher will also be able to easily review the timestamp associated with the assignment. The biggest concept behind Inclusive Classroom is the idea that many students learn in environments without stable internet connections. The client app will be able to operate completely without the internet. When the software is set up by the school or parent(s) with internet access, the student can, in theory, go the entire year without internet until the last day. All teaching materials can be prepared beforehand, and the software will manage all submissions, lectures, etc. to keep the student on pace. If the student can access the internet intermittently throughout the year, the software will automatically synchronize with the backend server, submitting the assignments as if the student had submitted them with internet access the entire time.

1.2 Scope

The prototype for Inclusive Classroom will include most, but not all the core features of the overall design. Students and teachers will both be able to login to the application and view their respective dashboards. Students will see a list of the classes they are enrolled in, and teachers will see the classes they are teaching. There will be an emphasis

placed on the automation aspects of the product. This includes a weighted priority queue for

downloading assignments, adding a timestamp when assignments are completed, detecting

Internet connection, and automatically submitting assignments when Internet connection is

detected. The students will be able to see current assignments and video links set up by the

teachers. The teachers will be able to access grading, creating assignments, and starting live

video sessions. This prototype will include a login screen for authentication.

1.3 Definitions, Acronyms, and Abbreviations
English as a Second Language (ESL): Students whose primary language in not English

High-speed Internet: Internet with consistent download speeds of at least 3.8 Mbps (Zoom)

Family Educational Rights and Privacy Act (FERPA): Federal law that protects the privacy of student education records

Google Classroom: "Free web service developed by Google for schools that aims to simplify creating, distributing, and grading assignments" (Google)

littleLearners: Former CS 410 group solution that emphasizes simple UI for students in the K-5 age range (Del Razo)

Stable Internet: Internet with less than 1% dropped packets (ICTP)

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1.5 Overview

       This product specification provides the hardware and software configuration, external

interfaces, capabilities, and features of the Inclusive Classroom prototype. The information

provided in the remaining sections of this document includes a detailed description of the

hardware, software, and external interface architecture of the Inclusive Classroom prototype; the

key features of the prototype; the parameters that will be used to control, manage, or establish

that feature; and the performance characteristics of that feature in terms of outputs, displays, and

user interaction.

2 General Description

       The prototype for Inclusive Classroom will consist of a client application and an API to

access the database. The client application will consist of the user interface that students and

teachers will both use, as well as some third-party integration such as Zoom. The main

concentration of the prototype will be automation that will make learning and completing

assignments simple for the student. This will include functionalities such as completing

assignments, watching video recordings, and submitting assignments all without being connected

to the Internet.

2.1 Prototype Architecture Description
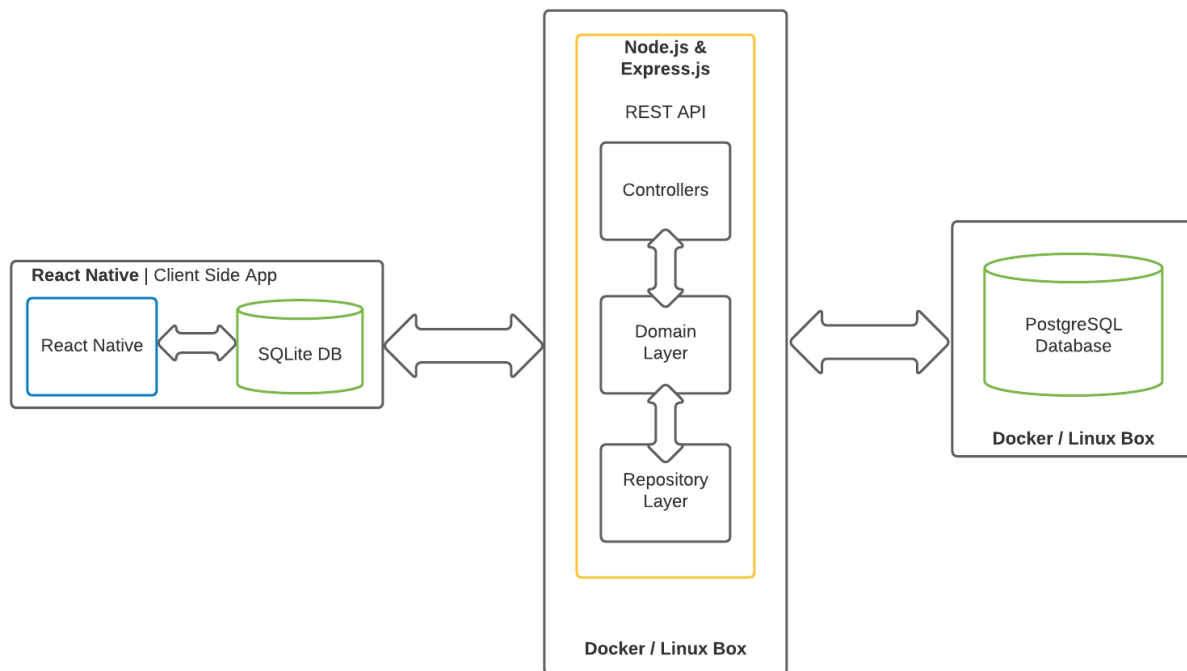
Figure 1: Prototype Major Functional Components

       The Inclusive Classroom prototype will consist of a client application, an API, and a database. Figure 1 shows how they relate to each other. The API will serve as the communication between the client application, used by students and teachers, and the database. The client application will allow students and teachers to login to Inclusive Classroom, view classes and class materials, create and complete assignments, and record videos and livestream. The database will store all necessary information such as usernames and passwords for students and teachers, user info to determine teacher/student status, and class materials including video recordings and assignments.

2.2 Prototype Functional Description

       The prototype for Inclusive Classroom will be able to be run on a Chromebook, which is the most popular device provided by public schools. Students and teachers will be able to register and set up a username and password to access their account set up by a school administrator.

Students will need to be connected to the Internet for the initial setup and to download course

materials. Once the set-up process is completed, the student will have access to all prerecorded

course materials and assignments without needing an Internet connection. When the device is

connected to Internet, it will download any new materials that have been added by the teachers

of their classes. This process will happen automatically so that the student does not have to

worry about hitting a refresh button to keep up to date. When a student completes an assignment

while not connected to the Internet, Inclusive Classroom will add a timestamp that will be

submitted with the assignment when Internet access is available so that the teacher will know

when the student completed the work.

2.3 External Interfaces

Inclusive Classroom will use hardware to allow users to interact with the main software.

Inclusive Classroom uses software that will communicate with the user and database to serve its

intended function.

2.3.1 Hardware Interfaces

Inclusive Classroom will be run on a Windows 10, Mac, or Chromebook device that has

Internet capability.

2.3.2 Software Interfaces

Inclusive Classroom will consist of a client application and a back-end API each with

their own software requirements. IC's client application will be a React Native web, Android,

and iOS application to ensure optimal accessibility for users. The client application will use a

SQLite Database for local storage. The API will use Node.js to execute JavaScript on the server-

side of the application. Inclusive Classroom's API will use Express.js built on top of Node.js to

increase functionality and handle HTTP requests. The API will communicate with a server-side

PostgreSQL database.

2.3.3 User Interfaces

The main user interface for Inclusive Classroom will be the client application. The client

application will be run on a Windows 10, Mac, or Chromebook device that has Internet capability so

users will be using a mouse and keyboard or a touch screen to interact with it.

2.3.4 Communications Protocols and Interfaces

The Inclusive Classroom prototype will communicate with the API using a REST format

and following the standards set forth in RFC 2068 concerning communication via HTTP and

HTTPS.