Lab 1: Inclusive Classroom Description

Travis Bennett

CS 411W

Professor Kennedy

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Table of Contents

Listing of Figures

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.

2 Product Description

Inclusive Classroom's (IC) primary goal 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.

2.1 Key Product Features and Capabilities

The Inclusive Classroom (IC) software will have key features and capabilities that distinguish it from the rest of the competition. The biggest concept behind IC is the idea that many students learn in environments without stable internet connections. The client app of IC 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.

At the beginning of the school year, teachers will be able to plan out the entire year, including all lectures, assignments, quizzes, exams, class updates, etc. When the student client

software is first set up, it will load all the preplanned data and manage it on the client-side. The

student will then be able to follow through with the class however the teacher-designed it. They

will be able to watch the lectures at their own pace, or a pace deemed by the teacher. They will

be able to complete assignments as they open (weekly, for example), submitting them with or

without the internet. In this way, as the internet is not required through the year, there will be no

degradation in student experience; the software will allow students in areas without internet

access, or limited internet access, to learn effectively. Even if the teacher can't plan out ahead of

time for the whole year, even the ability to add in assignments on a weekly basis will help

students with limited internet access to still be able to get their needed assignments.

The software will be available on nearly all operating systems and computers. It will

support Chromebooks, as well as the main three operating systems, Windows, Mac OS, and

Linux. By supporting these, IC will be an option for nearly all school systems across the United

States.

2.2 Major Components (Hardware/Software)

The client applications for Inclusive Classroom will be available on Windows 10, Mac, and

Chromebook operating systems. This application will be the interface between the user and the

API. Figure 1 shows how the client applications will interact with the database through the API.

Teachers and students will each be required to authenticate before accessing the client

application. This is where they will be able to view live streams or recordings, view or upload

video recordings, and download or upload assignments. The API will be built with Node JS,

Express, Postgres, and Redis. This will be used to save videos to the database, handle user

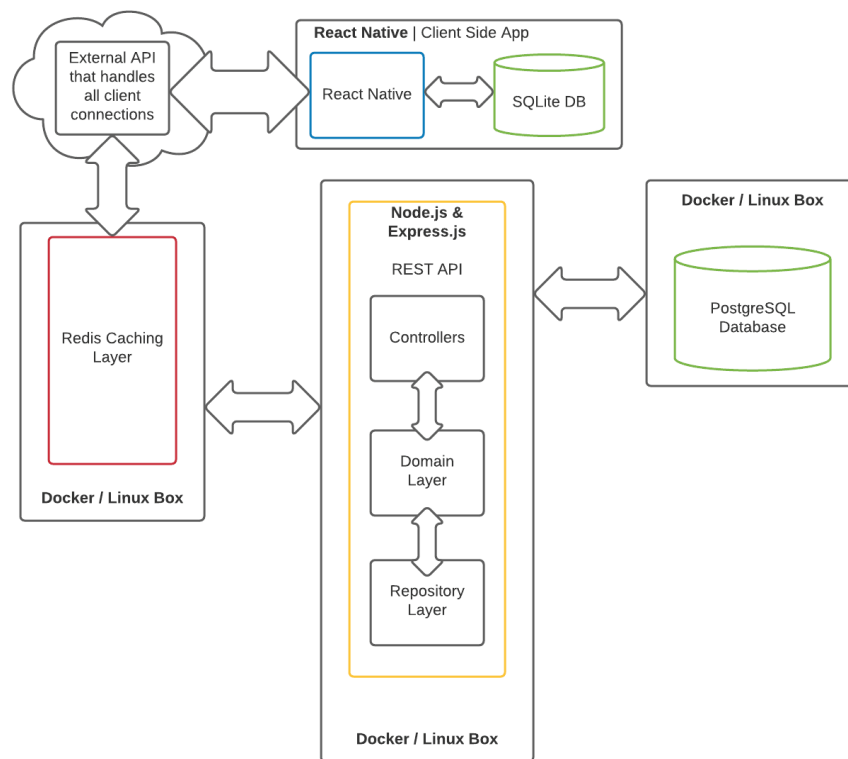authentication, and send push notifications to the user.

Figure 1: Major Functional Component Diagram

3 Identification of Case Study

Inclusive Classroom will offer a solution to online learning for lower income students aged

K-8 without access to stable and reliable internet. These are students that would generally rely on

the help of parents or teachers for technical or internet issues. Inclusive Classroom is not limited

to students that do not have good internet at home, it could be used by all students. When the

pandemic comes to an end, and mass remote learning with it, Inclusive Classroom will still

function well as a remote learning option for students with disabilities or homeschool students.

4 Product Prototype Design

The Prototype for Inclusive Classroom will include most, but not all the core features of

the overall design. Figure 2 outlines the differences in features there will be between the

product and the prototype. 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.

Feature	RWP	Prototype
Account Roles	Student, Parent, Teacher, Admin, IT	Student, Teacher, Administrator(limited) only
Automatic Internet Detection	Yes	Yes
Background Workers	Yes	Partial
Complete/Submit Assignments	Yes	Yes
Create Assignments	Yes	Yes, limited in types
Grade Assignments	Yes	Yes
Postdate created content	Yes	No
Recorded Videos	Yes	Yes, may not auto record
Reporting	Yes	No
Timestamp Completed Assignments	Yes	Yes
Video Conferencing	Yes	Yes
Weighted Priority Queue	Yes	Yes

Figure 2: Product vs Prototype

4.1 Prototype Architecture (Hardware/Software)

   The Inclusive Classroom Prototype will also be compatible with Windows 10, Mac, and

Chromebook operating systems. Figure 3 is the revised major functional component diagram for

the prototype. The prototype will include the client-side application, an API, and a database.
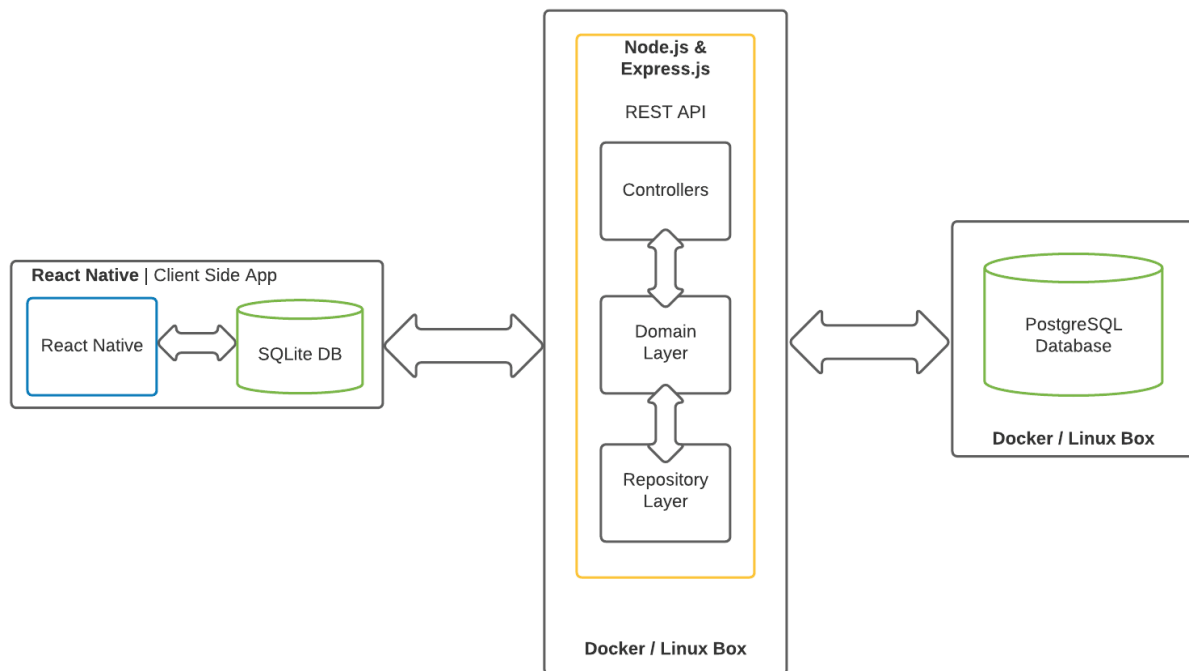

Figure 3: Revised Major Functional Component Diagram

4.2 Prototype Features and Capabilities

   The prototype will include most of the important features of the Inclusive Classroom

product. Teachers and students will be able to create accounts and login. Teachers will then be

able to create classes and add students to those classes, create assignments, and schedule zoom

sessions for students to join. The students will be able to view the classes they are assigned to,

view and complete assignments, and join a live zoom session or watch a recording.

4.3 Prototype Development Challenges

The obvious challenge that is expected while completing the Inclusive Classroom Prototype is the time constraint of just one semester to complete it. A challenge that goes along with the time constraint is the time needed to learn new technologies and frameworks required to complete the prototype. There will be a bit of a learning curve as it pertains to the components of Inclusive Classroom. There will also be time needed to test the prototype on the various operating systems that are being targeted. Chromebooks will be the focus due to the public-school access, but Windows and Mac operating systems will also be compatible.

5 Glossary

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

English as a Second Language (ESL)

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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