VR CLASSROOM

Experience Classroom-like feeling @ home.

[1]Sanjit Chakrabarti, [2]Shubham Bartia
[1] Pursuing B.E, [2] Pursuing B.E
[1]Computer Science,
[1]Sri Revana Siddeshwara Institute of Technology, Bengaluru, India

Abstract: This paper has been undertaken based on a project, to make a Virtual Reality (VR) website for getting a classroom-like feeling from home. Due to advancements in Javascript technology, a VR website can be made easily and deployed on a proper Web server. A VR environment will help students get the classroom-like experience and they can interact with their teachers, like in a real classroom, For slow internet users or for deaf people, Speech-to-Text will be added. Speech-to-Text will convert the speech of the teacher to printed words, on the wall of the classroom. All things will happen from the comfort of home in smartphones.

IndexTerms **- Aframe.io, Javascript, Virtual Reality, NodeJs, Webrtc, Speech-to-Text, mooc**

I. Introduction

Nowadays, MOOCs (Massive Open Online Courses) are almost becoming mainstream. Many students prefer to study at home, through the internet, to avoid the distraction of a real classroom. Few universities also provide MOOC as a way for getting a degree credit also.

Massive Open Online Course (MOOC) is an online course aimed at unlimited participation and open access via the web. In addition to traditional course materials, such as filmed lectures, readings, and problem sets, many MOOCs provide interactive courses with user forums to support community interactions among students, professors, and teaching assistants, as well as immediate feedback to quick quizzes and assignments.

II. Problem

On average, only 6% of all HarvardX open online course registrants earn a certificate. It is estimated that only 5 to 10 percent of active participants do proceed to complete MOOCs. Some learners complete one or more modules of their courses, leaving out the rest. The main reason is that students don't get immediate feedback. They don't get classroom-like interaction and experience in a MOOC and so, they don't get the motivation to complete the course.

III. Solution

Therefore, to solve this, we present the Virtual Reality (VR) classroom. This will help students get the experience of a real classroom from the comfort of their home while getting immediate feedback from their teachers. Students can interact in the VR classroom, like in a real classroom. This will motivate students to complete the course on time. And for slow internet users or deaf students, we have added a way to convert speech of the teacher into text, to be shown on the walls of the classroom. The text will be saved in the form of a text file, as notes for the lecture.

IV. MOOC Info

A lot has changed since 2012 when the year the New York Times dubbed it "Year of the MOOC." In India, over the next 10 to 20 years, there will be more than 300 million people that will enter the workforce. And there's no real infrastructure available to train that many people. MOOC can fill that gap.

But the completion rate of a MOOC is still a huge problem.

Traditional MOOC flow

As you can see from the above figure that the traditional MOOC was mainly about watching videos, doing assignments and getting certificate based on score. The looks like a very mundane flow. So, students are bound to lose motivation.

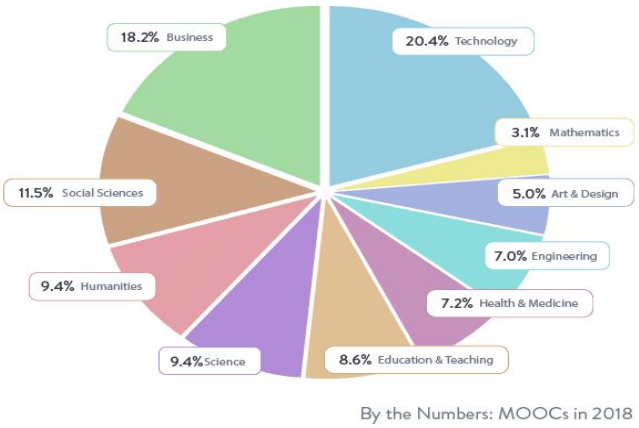
i) Trends

The number of courses has been growing steadily at the same rate now. We have more than 11,000 courses from 900 universities. 2,000 new courses were added to the list this year alone. Just two years later, in 2017, this market has grown to reach an enormous $255-billion. This represents 238% growth. MOOCs have generally become more flexible. There are shorter courses available. But the discussions between students now seem less interactive and tend to be individual statements of opinion.

The number of available MOOCs has grown dramatically in the last few years, but since user growth hasn't kept up, each course is getting fewer users. The completion rate of MOOC is still a huge problem. Students tend to leave the course halfway. The main reason is that students don't get immediate feedback. They don't get classroom-like interaction and experience in a MOOC and so, they don't get the motivation to complete the course.

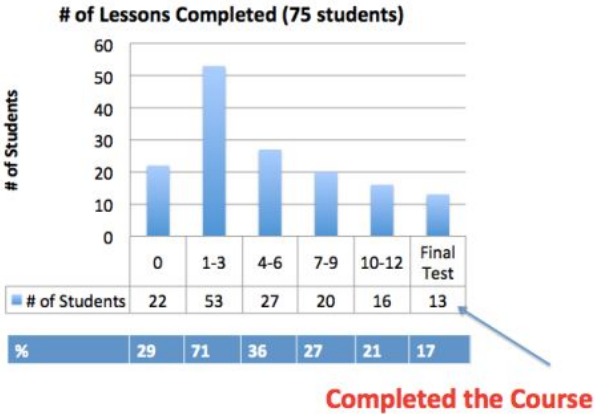
ii) Completion rate data

Typical rates for learners who have logged into the platform at least once and then go on to complete the course is between 5 to 10 percent of active learners. On average, only 6% of all HarvardX open online course registrants earn a certificate.



Subjects took by students (Classcentral)

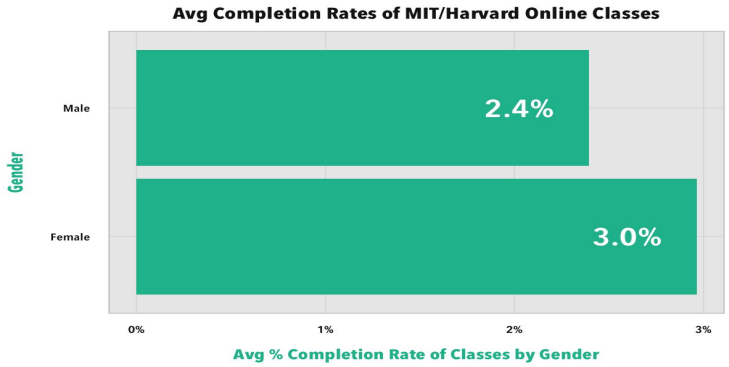
As we can see from the above graph that students in the technology field (20%) take the most number of MOOC. That followed by students taking a course in the business field (18 %) and then students in other fields.



Completion trend in one of the statistics course

Now looking at the completion rate above provides a bleak picture about the percentage of students completing a MOOC. In one of the MOOC about statistics, the percentage of active students dropped from 71% to 17%, when the course was at its end. This shows the motivation of students in course completion.

Course completion certificate shows if a course has been completed. It can show the progress a student is making towards finishing the course according to specific criteria. The criteria can include meeting an activity's grade level or a manual checking "complete" by either the student and/or teaching. But according to the above figure, only 17% of registered students got the Course completion certificate.



Now, from the above figure, we can say that there is not much difference between gender when it comes to average completion rate. Both male and female students seem to have almost similar course completion rate.

We conclude that gender has nothing to do with course completion. So, we should not be biased, based on gender when it comes to course completion rate.

3.3 MOOC vs Distance learning

In MOOC, the content is accessible 24/7. Media is open source. Students are encouraged to share and contribute materials. Contents are edited when needed.

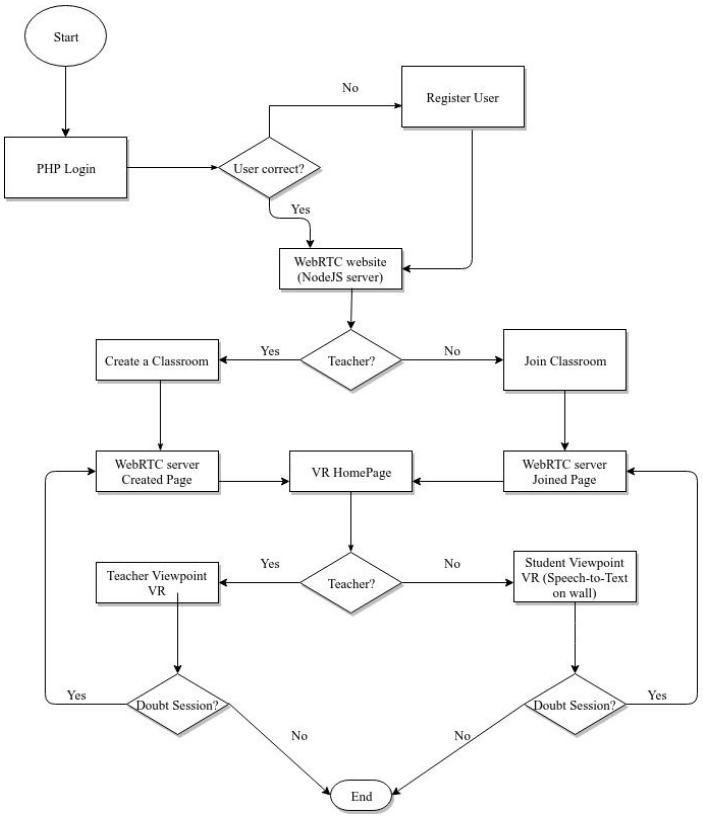
In Distance Learning, materials are available one week at a time. Media is restricted by the university. Contents are edited only at the semester beginning.

In MOOC, lectures are pre-recorded. All content is available from the start in the browser. It is a self-paced/customized learning path. Feedback is dependent on classmates. The course is open-ended with no due dates.

In Distance Learning, students have to travel, to get lectures. Group learns at the same pace/linear learning path. Feedback is dependent on teachers. The course is closed-ended with due dates

I. Technology used

In this section, we are going to discuss the technology used while creating the VR classroom:-



Flowchart of the technology used

i) PHP login[1] with MySQL[2]

With PHP, you can connect to and manipulate databases. MySQL is the most popular database system used with PHP. The MySQLi functions allow you to access MySQL database servers.

Students and teachers first need to login into the website, created by PHP. After putting the credentials, the PHP connects to MySQL database, to verify the credentials. If the credentials are correct then teacher or student can log in. Or else, they are asked to register the account.

This is the first part of the service, to check whether the teacher or the student has a valid account or not. PHP has the most reliable way to create a login page. And MySQL is one of the most secure databases, to store login credentials.

ii) WebRTC[3] with NodeJS[4] server

WebRTC[3] (Web Real-Time Communication) is a free, open-source project that provides web browsers and mobile applications with real-time communication (RTC) via simple application programming interfaces. It allows audio and video communication to work inside web pages by allowing direct peer-to-peer communication, eliminating the need to install plugins or download native apps. Supported by modern web browsers, WebRTC is being standardized through the World Wide Web Consortium (W3C) and the Internet Engineering Task Force (IETF). It is one of the most reliable ways to do video calling in modern web browsers. Node.js[4] is an open-source, cross-platform JavaScript run-time environment that executes JavaScript code outside of a browser, on a server. NodeJS as a server is very powerful with very little downtime. Node.js lets developers use JavaScript to write command line tools and for server-side scripting—running scripts server-side to produce dynamic web page content before the page is sent to the user's web browser.

So, after successful login, teacher or student is redirected to a webRTC video calling site, to be used for clearing doubts. The webRTC is deployed on the NodeJS server. Teachers can create a classroom and students can join that classroom. After the creation of rooms, teacher and student will be redirected to the VR homepage.

iii) Aframe[5] WebVR framework with NodeJS[4] server

A-Frame[5] is a web framework for building virtual reality (VR) experiences. A-Frame is based on top of HTML, making it simple to get started. But A-Frame is not just a 3D scene graph or a markup language; the core is a powerful entity-component framework that provides a declarative, extensible, and composable structure. It was originally conceived within Mozilla. A-Frame supports most VR headsets such as Vive, Rift, Windows Mixed Reality, Daydream, GearVR, Cardboard, Oculus Go, and can even be used for augmented reality. Although A-Frame supports the whole spectrum, A-Frame aims to define fully immersive interactive VR experiences that go beyond basic 360° content, making full use of positional tracking and controllers.

After getting redirected to VR homepage, there are two options. Teacher viewpoint and student viewpoint. If clicked on teacher viewpoint, the teacher is redirected to a VR environment, facing the students in the class. Students is in the form of an avatar. And besides the teacher viewpoint, there will be a board, where the teacher can play lecture video or write on notes on it. For video - <a-video> tag will be used. All the entities will be in the <a-scene> tag. Each tag corresponds to their own function.

If clicked on student viewpoint, the student is redirected to a VR environment, facing the teacher and the board in the class. Students can see, what's going on the board and see the avatar of the teacher. Students and teachers can interact with each other using webRTC, opened in another browser tab.

Everything is deployed on the NodeJS Server for reliable performance. And all entities of the classroom is made using the aframe libraries, running on the modern web browsers.

iv) Speech-to-Text[6] with Google Cloud API:-

Google Cloud Speech-to-Text enables developers to convert audio to text by applying powerful neural network models in an easy-to-use API. The API recognizes 120 languages and variants to support your global user base. You can enable voice command-and-control, transcribe audio from call centers, and more. It can process real-time streaming or prerecorded audio, using Google's machine learning technology.

Using Speech-to-Text, the speech of the teacher is converted into text and to show it on the walls of VR. Speech-to-Text will help deaf students to understand the concept properly. Speech-to-Text will also help students with a slow internet connection. They can read the text if the audio is not clear. At the end of the lecture, the whole lecture of teacher will be stored in a text file, as lecture notes (using Javascript File Output Function). Students can use it to review the lecture later or can use it as lecture notes.

IV. Final Conclusion and Future Enhancement

According to Sebastian Thrun (Founder and President, Udacity, a major MOOC provider), completion rates shot up to a whopping 90%. when their mentors and coaches started giving immediate feedback to the students.

VR classroom aims to increase the student-teacher interaction in the MOOC. Students get the experience of a real classroom from the comfort of their home while getting immediate feedback from their teachers. This will motivate students to complete the course on time. While for slow internet users or deaf students, there is a way to convert speech of the teacher into text, to show on the walls of the classroom. At the end of the lecture, the whole lecture of teacher will be stored in a text file, as lecture notes. This can be used by students to review the lecture later or to use as lecture notes.

Students and teachers will only need a smartphone and VR headset, to open VR website.

To enhance the product further, we have to find a way to add avatars of a student, depending on the number of students logged in. Right now, only fixed four student avatars are shown in the VR classroom. We have to find a way to integrate all the modules in the VR only, including video call, chat and doubt button.

V. Acknowledgment

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Santosh Viswanatham- For telling us about the aframe WebVR framework. Linkedin - https://www.linkedin.com/in/isantoshv/

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