**Technical Report - ViSmart**

**1. Problem presentation**

Because of the current global pandemic, multiple restrictions have been established in order to ensure that as few people get sick. This means that all the learning system has to move in an online environment. Are we ready for such challenges?

Since everybody stays at home, many companies started to develop solutions for the upcoming need of an online education system. Most teachers have chosen platforms that are not necessarily focused on the learning process or that want to facilitate the learning process of the students.

Because they are intensely used, applications have to provide a top-level security system to ensure user data protection and no data leakage. Sometimes, because of the workload, the applications have to be optimized regarding the hardware/software components.

**2. State-of-the-art**

Many video applications rely on video streaming such as YouTube and Netflix, whereas those apps occupy most of the Internet traffic. Video streaming strategies vary accordingly to the type of containers such as Silverlight, Flash, or HTML5, and they depend on the way of data is exchanged on the traffic from non-ack-clock ON-OFF cycles to bulk TCP transfer. One of the features of video streaming is that the content is download while before the movie starts playing for viewers. Therefore, the video content shows first images along with audio when there is received a sufficient amount of data (Rao et al., 2011).

One of the main concerned for video quality is over the HTTP adaptive streaming generated by those artificial streaming mechanisms that offer the best viewing experience. Those algorithms should estimate a fair TCP throughput of the equal data chunk of the compressed representation of the video. This rate should treat the buffer state and not the case of playback video which can lead to significant loss of quality (Sani et al, 2017).

There are plenty of other applications that ensure video streaming, live chatting and screen sharing. One of them is Wire, an encrypted communication and collaboration app created by Wire Swiss. It is available for iOS, Android, Windows, macOS, Linux, and web browsers. Wire offers a collaboration suite featuring messenger, voice calls, video calls, conference calls, file-sharing, and external collaboration – all protected by a secure end-to-end-encryption.

Another one is Discord which is a group-chatting platform originally built for gamers, but which has since become a general use platform for all sorts of communities. Discord is divided into servers, each of which has its own members, topics, rules, and channels. It also allows users to voice/video-chat, as well as livestream games and other programs from their computers.

**3. Your solution**

Because of the necessity of an online learning platform we propose an focused and efficient way for the teachers to present their courses, and for the students to attend, learn and document about said courses.

Our project will provide teachers with an easy way to share their courses and materials with students. The application will have an intelligent video streaming system that detects if there are any noise issues and will automatically enable subtitles and the teacher will be notified about the problem. All the courses will be recorded and the students will have access to them any time. Based on the presentation subject, the application will suggest other relevant online resources for students (software, articles, code, examples, images, sites). When the courses will be saved into the database, the application will get rid of unnecessary pauses of speech, irrelevant talks or other off-topic questions.

ViSmart is composed of multiple components. The main component is the Video Streaming Platform(VSP) because all the other functionalities are related to this module. This component will provide screen sharing functionality, will have a chat integrated, a variety of video and audio settings, will check for audio disturbances and it will activate subtitles if needed. The VSP will check if relevant materials are provided according to the course topics. This component will grant access to users into specific classrooms and the teacher will be able to accept, reject or kick a student from the meeting.

The next component of the application is the Classroom which is responsible with the creation of new classrooms and video lessons by a teacher account. In this module the participants can write offline messages, will be able to view past courses as well as the provided materials for them. All the data involved in those processes will be read from the database and also stored into it.

Another component used is The Rest Application. The operations made into the application will use a REST API to store the data into the Database. Before videos are saved into the Database they are processed using the API and then it will be saved into the Database. Also into the database it will be saved the offline messages for further display.

**4. Results, Evaluation**

As a result of developing this application, the teacher and students that are using our application will have different functionalities and rights based on their role. Also the admins will be able to create accounts of all types.

Students will log into the application and will send messages to other members and will access provided materials and will watch recorded courses.

Students that will participate at/watch video lessons, will send messages to other members or to access relevant materials for various courses. Teachers will initiate video lessons, provide relevant materials and answer chat questions for students.

The admins will be responsible with the creation of the accounts and to supervise the application functioning.

The most important result of this project are the features implemented to provide access to video streams of courses and seminaries for students and teachers as well as facilitating the learning/teaching process.

**5. Comparison with other solutions**

Unlike other applications, ViSmart disposes of a variety of video and audio settings. It will check for audio disturbances and irrelevant background noises and will activate the subtitles for the video stream if required. It will also check if there are any other relevant materials online regarding the current presented topic.

The teacher will have multiple control options in his virtual classroom, he will be able to accept/reject a student and even kick or mute.

The student has the option to access older courses due to the integrated video saver, which automatically save into a database the classrooms that he has access (the teacher can do this as well). The teacher can provide his own materials and articles as a bonus to his course for the students to read, learn and access at will.

In the classrooms the other participants will have the option to write and send online/offline messages to others. This is similar to how Discord chat servers work.

**6. Future work**

There are many improvements that we can provide ViSmart with:

* Create an online test platform adjacent to the web streaming one in which the teacher and create tests for his students, then save the result on his computer to check then later post notes in an online catalog.
* Create and online schedule for teachers to easily update, modify and help students be organized. Polls could also be created regarding the day/hour when some exams will take place.
* Mail notifications with reminders when a course/exam will take place or when a teacher is live and available to explain topics to the students.
* Live whiteboard on which the teacher can write and draw stuff, and easily create charts, diagrams and statistics.
* A chatroom dedicated to questions and answers that students might have, but separated by topics, so as a teacher you can easily find your topic and provide the students with some answers.
* Dedicated platform only for the faculty conferences between teachers.

**7. Conclusions**

In this trying times, a platform to facilitate the online learning is very important and welcomed. It helps both students and teachers to temporarily substitute the classic method of teaching, but also enhancing it with new modern age solutions(video streaming, audio detection and auto-subtitles enable).

ViSmart was both challenging and fun to make, we improved our coding, communication and team-working skills.

**8. Bibliography**

1.Rao, A., Legout, A., Lim, Y., Towsley, D., Barakat, C. and Dabbous, W., 2011. Network characteristics of video streaming traffic. Proceedings of the Seventh Conference on emerging Networking EXperiments and Technologies on - CoNEXT '11,.

2. Sani, Y., Mauthe, A. and Edwards, C., 2017. On the trajectory of video quality transition in HTTP adaptive video streaming. Multimedia Systems, 24(3), pp.327-340.

3. Hartsell, Taralynn, and Steve Chi-Yin Yuen. "Video streaming in online learning." AACE Journal 14.1 (2006): 31-43.

4. Apostolopoulos, John G., Wai-tian Tan, and Susie J. Wee. "Video streaming: Concepts, algorithms, and systems." HP Laboratories, report HPL-2002-260 (2002).

**9. Links**

1. https://matrix.org/

2. https://medium.com/twitch-engineering/twitch-engineering-an-introduction-and-overview-36ceeb8875de#.unpfgyzen

3. https://dev.twitch.tv/docs

4. https://www.twitch.tv/

5. https://blog.twitch.tv/en/2020/01/15/introducing-our-2020-twitch-research-fellows/

6. https://www.pacetechnical.com/brief-history-streaming-media/

7. https://element.io/

8. https://wire.com/en/