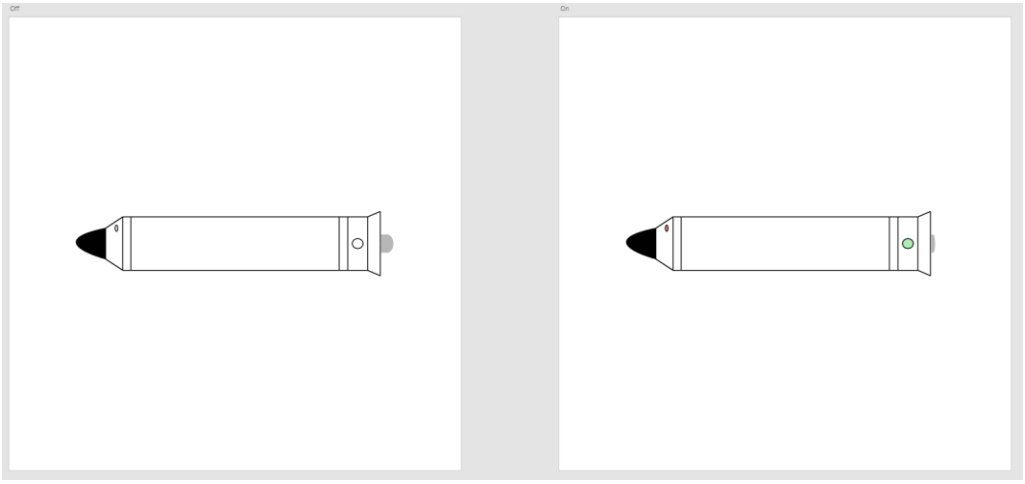
A. High-Fidelity Prototype

Problem: Hybrid-synchronous learning lacks an interactive, collaborative environment that is present in traditional face-to-face learning. Accommodating both in-person and online students has caused teachers to resort to sharing their screen in the form of a PowerPoint or slideshow and simply talking through the points, rather than explaining examples and working out problems in real time for the students. This way of learning and teaching is monotonous for both students and teachers, and there needs to be some sort of whiteboard-esque technology that allows for a more engaging learning setting.

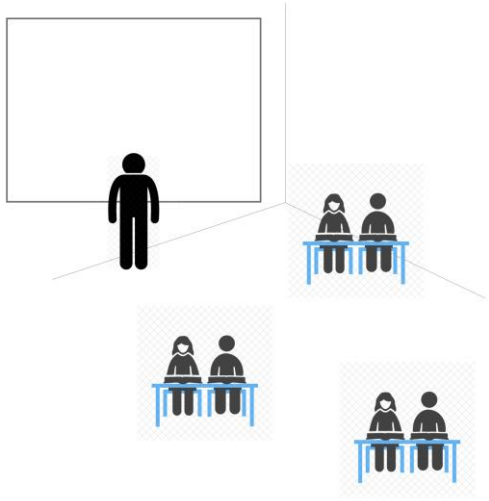
Relevant User Stories:

1. As a professor, I want to have the option to transcribe my writing onto a whiteboard so I can lecture in a traditional classroom setting.
    - Prototype:https://xd.adobe.com/view/518f4e79-5ab2-4860-8a32-70479354601a-04dc/
    - PNG Artboards:
        i. 
    - Extended Description: The introduction of an infrared pen brings the professor back to the whiteboard, and therefore back to a more traditional style of teaching. This solves the problem of having the teacher simply talk through examples on a PowerPoint, which creates a very tedious and tiresome learning and teaching experience. Additionally, having the

professor stand in front of the class while also being able to cater to online students would create an incentive for students that are able to attend class in person to do so. The pen has a button on the top that allows the user to click it on and off activating the infrared light. This allows the professor to stand up and teach in a traditional classroom setting while also transcribing onto the Zoom screen for the online students.

- Demo Video: https://youtu.be/QE--DZ1OSXA

2. As a professor, I want to have the option to transcribe onto a shared screen (Zoom) so I can better replicate the experience of an in-person class while lecturing online.
    - Prototype:https://xd.adobe.com/view/acbffb0f-82ef-47c4-bf82-3bb1c3550c1b-f9ec/?fullscreen
        i. Attributes: use of Icondrop by Iconscout plugin on Adobe XD
    - PNG Artboards:



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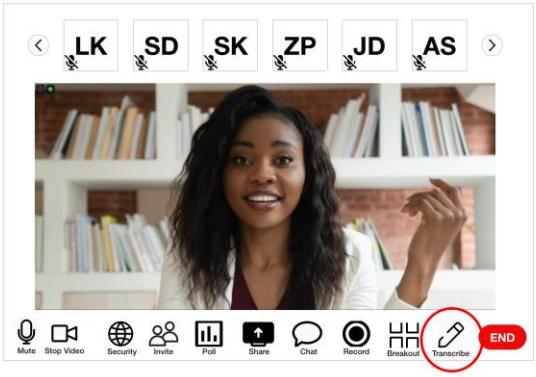
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Invite
Poll
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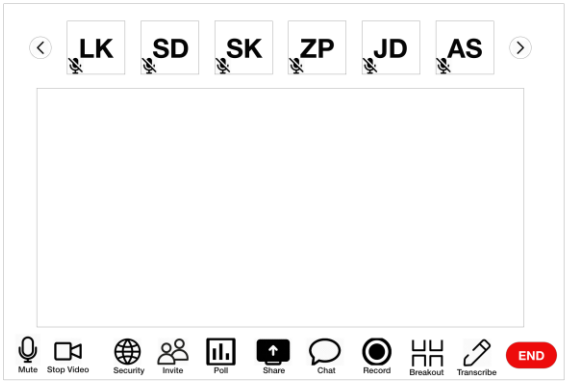
Record
Breakout
Transcribe
END

ii.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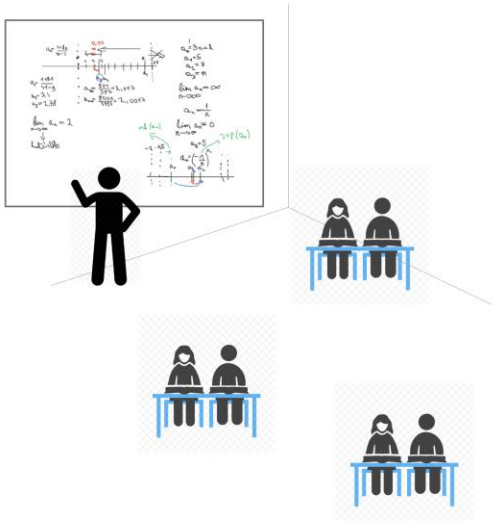
iii.



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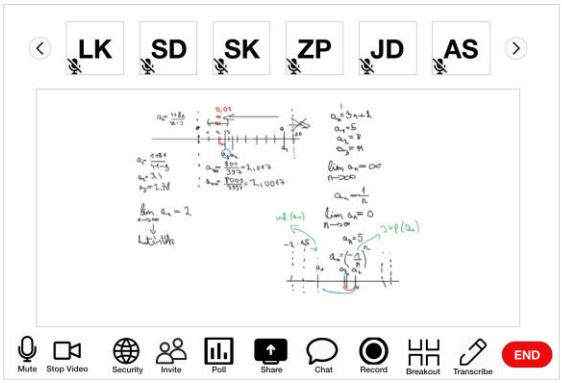

v.

- Extended Description: The main design element is the addition of the transcribe button. It allows a new capability for the meeting host by providing a way for the professor to write on the whiteboard like a traditional class would take place, while this writing is also transcribed to the Zoom screen. This addresses the problem of the professors simply talking through examples on a PowerPoint by allowing the professor capability to draw, write, and/or explain a problem on the whiteboard, while also sharing this writing over Zoom with online students. Its placement on the main navigation bar at the bottom of the Zoom page makes it easy to identify and use. When the button is clicked it starts the infrared reading software.
- Demo Video: https://youtu.be/xehQSoFywQ8

B. Testing Protocol

Research Question: Does the learning experience of students and the lecturing experience of the professors improve with the infrared pen and Zoom transcribe button combined technology?

Methodology: A combination of observation, surveys, and interviews would serve as a good mix of methods to test the effectiveness of our product as a solution. With observation, we would be able to watch the class both in person and online and

compare a class that uses the infrared pen/Zoom transcribe button to a class that does not. This insight would give us first hand exposure to how the new technology is changing the way the class works. Surveys would be beneficial to get honest, anonymous data from students/professors about whether or not they feel the new technology is improving their learning/teaching experience. This could be done by sending out a survey at the end of the semester asking if they saw or felt any difference in their participation and retention of the material with the technology improvements. Interviews would be a good way to test how the product is working, what can be improved, and what is not needed. It would be beneficial to hear from both students and professors in interviews

Testing Procedure: Our general testing procedure would be a comparison between in-person and online/hybrid classes. We would have a couple different groups of students. All of our groups would consist of hybrid classes where some of the students attend in-person and some attend virtually via Zoom. The control group would consist of a hybrid class that uses the standard zoom when virtual. The experiment group would use the infrared software from virtually attending students. An important detail of the control is that they will most likely have to log into Zoom even when attending in person. We hypothesize that this drives attendance down and thus for the experiment group we want students attending in-person to not be required to log into Zoom. Our null hypothesis would be that attendance stays the same between the control and the experimental groups.

Informed Consent: To comply with the informed consent principle, a presentation would be given to the group of students explaining to them how the software works, our motivation behind the study, answer any questions, and finally obtain written consent.

Data: Attendance and participation will be collected for both classes that use our technology and classes that do not. Comparing the difference in the two classes will allow us to see how or if our solution is effective in encouraging students to attend and participate in class. Additionally, satisfaction would be collected from the survey to compare student satisfaction between taking a class with the new technology versus taking a class without the technology.

Analysis: Text analysis can be used to reveal patterns in attendance based on the data sets. Statistical analysis can be done by averaging the final grades of students in a class that used the technology versus those of students in a class that did not use the technology.

Conducting the testing procedure: Surveys will be taken online, which would not require direct contact, allowing for safe gathering of feedback during a pandemic. The gathering of our dataset will not require direct contact so testing can be performed safely during a pandemic.

C. Final Summary Video

https://youtu.be/Uvjh3v9r2yk