Currently, virtual reality lacks products which allow users to collaborate with one another effectively. Namely, there is no dominant text input tool for users that would give the user a fully immersed feeling. Mimicking the feeling of writing on a notepad or a white board is impossible, which can make someone in a VR environment uncomfortable and interfere with their work. We were tasked with finding a way to bridge that gap.

**Introduction**

In order to utilize a physical writing pad, we need to be able to see the pad even when we are in the VR environment. By attaching ArUco markers on the pad, we can use an external camera mounted on the Oculus to detect the 3D position and orientation of the physical writing pad.

Since Oculus Quest do not support external camera input, we used a portable embedded board (Raspberry Pi) for the camera and run C++ detection code on it.

The detected pad position and orientation are then transmitted to Oculus Quest. The communication between Raspberry Pi and Oculus Quest are done by TCP connection.

The received position and orientation value will be set to a writing pad unity model inside the VR environment, mapping the physical writing pad motion.

**Our Solution**

- **Project writing pad to VR environment**
  - Utilized an Arduino, 100 kΩ Resistors, and a multiplexer
  - Touch surface was designed using a silver conductive ink pen which was used to draw transmitting and receiving lines on paper
  - Initial findings showed that the touch sensor did work based on the output of the serial plotter
  - Further analysis showed that, though the sensor could sense, it struggled with pinpointing the location of the touch or the pressure
  - Finally, we decided that with our time frame and needs, this was not feasible

- **Building the Unity Note-Taking Application and Creating a VR environment**
  - To do a tactile feel and surface to write on, we chose the Wacom Tablet. The Wacom tablet allows us to read user input through a cartesian coordinate format. These coordinates are transmitted over a networked UDP connection to the oculus quest.
  - The Unity application takes the position of the user on the tablet, and renders a stroke as per the coordinates received, thereby creating a note-taking functionality. This was displayed onto a whiteboard. We added extra features such as an Undo function, Eraser Features, and Sticky Notes that can be attached onto the board.

- **Future Work**
  - We also created a VR environment using Moonbeam’s 3D assets that helped create an office environment. Our final application allows us to view the 3D render of the Wacom tablet and draw on it so we can adjust accordingly.

- **Conclusion**
  - The goal of our project was to design some type of interface that helped make collaborative work much easier. Our final solution was able to solve that issue by allowing the user to write directly on to a writing tablet that would be mirrored in the Virtual Reality environment to give the user the most realistic feeling possible. We hope that this system we designed will be a good starting point for our Industry Mentors to use in their continued work.