Chapter 1

Discussion

From the investigation of this study, we found that encoder based kinematic model is not the best approach due to its limitations [4, 3, 5]. This is because of its inherent nature of wheel slippage.

Even if the ArUco marker gives absolute posotion and orientation, the detection of the ArUco marker is not robust. This is because of the motion blur and occlusion.

However, we managed to address this issue by employing a deep learning technique. This proved to be an efficient method for determining the position and orientation of the Instrumented Arm-Skateboard (ArmBo) [6, 1, 2].

This allows us to track the position of the ArmBo in real-time, with a low resource hardware, instead of relying on a high-end GPU. This makes the ArmBo more affordable and accessible to the patients.

To avoid marker occlution, we have used three ArUco markers. This allows us to track the ArmBo even if any two of the markers is occluded.

This simple setup can be used in both clinical and home settings.

1.1 Future Work

- The ArmBo will be equiped with load cells in the arm rest. This will help us understand the amount of loading is given to the skateboard while performing the therapy. The arm rest will be spring actuated, as it will give the users haptic feedback while performing the therapy.

- We will be doing a usability study with healthy subjects, and improve the usability of the ArmBo. Following which we will do a patient trial.

Chapter 2

Conclusion

In summary, we have created an affordable, open-source, and user-friendly arm skateboard, ArmBo, designed for arm motion therapy analysis. All components, including software, hardware (CAD models), and firmware, are open-source and can be easily customized to meet user requirements.

The algorithm, powered by the YOLOv8n mobile model, doesn't necessitate a high-end GPU. It can operate at up to 33 Hz using only a CPU, making it compatible with low-resource devices like a Raspberry Pi 4 or a laptop.

ArmBo's standout features include its extreme portability, the need for just a 720p webcam, and its quick setup time. These make it adaptable for use in diverse settings, from clinics to homes. It functions as an effective tool for patient arm movement analysis, providing real-time feedback.