R2 Literature Survey Summary

Table tennis ball launchers, also known as ball pitchers, have become essential tools in training and skill development for table tennis players. Over the years, various designs have been introduced to meet the needs of athletes at different skill levels. These launchers are designed to deliver balls at varying speeds, spins, and trajectories, allowing players to practice specific shots or general gameplay scenarios.

Early Developments and Commercial Products

One of the early commercial launchers, the TTmatic 303A, is a single-wheel-based design that allowed basic ball delivery with limited control over spin and trajectory. However, it required manual adjustments, making it less ideal for high-level training sessions (Jayabalakrishnan & Achanta, 2013). Other commercial products, like the Donic Robo-Pong 2050, introduced more sophisticated features with multiple ball speeds and spin settings, but still lacked remote control options and real-time adjustability, which limited their utility in automated long-term training.

High-Fidelity and Custom Designs

To address the limitations of early commercial products, research into custom-built ball launchers focused on delivering more precision and control. A significant contribution to the field was AIMY, a three-wheeled ball launcher capable of generating speeds and spins that matched advanced human players. This system allowed remote control via Ethernet or Wi-Fi, making it suitable for long-duration, large-scale training, and integration with reinforcement learning models (Dittrich et al., 2023). AIMY was found to deliver accurate, reproducible ball trajectories, enabling sophisticated training scenarios that could not be replicated by earlier designs.

Sensor-Based and Robotic Arm Applications

Incorporating sensor technologies for trajectory prediction has also advanced the development of table tennis robots. Research by Zhang et al. (2010) and Koç et al. (2018) utilized visual measurement and prediction systems to allow robotic arms to simulate human-like ball trajectories, accounting for variables such as gravity, air resistance, and the Magnus effect. These advancements were crucial in improving the performance of robotic systems, as trajectory prediction played a significant role in enhancing the accuracy of ball launchers.

Multiple Style Launchers

More recently, mTTTbot, developed by Taşcı (2023), introduced a highly versatile, mobile-controlled table tennis ball launcher capable of executing a wide range of shots, including spins and slices. This system incorporated a user-friendly mobile application, allowing athletes and coaches to adjust the training parameters in real-time. The mTTTbot also addressed issues such as ball retrieval and continuous ball launching, enabling players to focus on their skills without manual intervention. Its design emphasized cost-effectiveness, making high-precision shot capabilities more accessible to a broader

range of players. However, limitations in distant-target precision highlighted areas for future improvements, such as the integration of three-wheeled systems for greater accuracy.

Conclusion

Overall, the evolution of table tennis ball launchers has moved from basic, single-speed systems to highly versatile, remote-controlled devices capable of simulating professional-level gameplay. The integration of real-time control, trajectory prediction, and reinforcement learning models has transformed ball launchers into vital training tools. Future research may focus on enhancing precision, especially for long-range shots, and further reducing costs to make advanced systems more accessible to amateur players.