iJournals: International Journal of Software & Hardware Research in Engineering (IJSHRE)
ISSN-2347-4890
Volume 11 Issue 12 December 2023

Snooker Table Surface Analyzer

Dhivij Patel
Dhirubhai Ambani InHigh School
divijppatel9@gmail.com

Reetu Jain
Chief-Mentor On My Own Technology
Mumbai, reetu.jain@onmyowntechnology.com

Abstract: *The sport of cue snooker has a long history in which precision and planning are considered highly valuable and important. The fundamental skill of cueing, where players must learn to strike the cue ball elegantly, accurately, and precisely while keeping total control, is at its core. Numerous factors that might make it difficult to maintain regular strokes are introduced by the special combination of player skill and cue stick handling in snooker. The solenoid motor manifests as a transformational force in the world of snooker. It serves as the protector of predictability, generating a constant and painstakingly regulated force to ensure that each shot is fired with unflinching precision. This completely negates the impact of outside variables like the player's physical prowess or the peculiarities of cue stick handling. An in-depth analysis of the complex dynamics affecting snooker's gameplay is done in this study. We set out on a quest to explore various snooker tables, discovering their various degrees of resistance. Notably, Snooker Table 4 distinguishes itself by exhibiting a greater degree of resistance than its counterpart, Snooker Table 1. This disparity demonstrates the solenoid motor's crucial contribution to preserving the regularity and uniformity of strokes. The solenoid motor has the ability to usher in a new age in snooker gaming as we consider the wider ramifications of this technical advancement. It has the potential to enhance the attractiveness of this venerable sport by guaranteeing consistent, exact strokes. More than just an improvement, the solenoid motor heralds a revolution that will transform snooker into a game known for its accuracy, dependability, and enduring appeal.*

Keywords: **Snooker table, Cue Stick, Roughness, Solenoid motor, constant force**

1. Introduction

Snooker has captivated players and viewers alike for more than a century. This game, which dates back to the late 19th century, has developed into a complicated and highly strategic sport that calls for dexterity, focus, and elegance. Snooker is a sport that is played on a rectangular table draped in a rich green fabric and presents a difficult but rewarding challenge to those who pick up the cue. Snooker is mostly a game of skill and strategy. Players pot colored balls in a certain order using a cue stick to get points dependent on the value of each ball. The goal is to score more points than your opponent. Snooker is unique in that you must pot balls in a specific order, which requires careful preparation and deft execution. The skill of cueing, where players demonstrate their mastery of deftly striking the cue ball with elegance, controlling its course, and potting balls with exceptional accuracy, is at the core of the game. They balance the complexities of spin, angle, and position with each stroke to outmaneuver their opponent. This voyage aims to reveal the fascinating complexities of a game that has persisted through centuries and still enthralls players on tables throughout the world, whether you're an experienced player, an aspiring enthusiast, or simply inquisitive about the world of snooker.

2. Literature Review

The research carried out by S Mathavan et al. [1] The trajectory of snooker balls with a single high-speed camera and image processing methods, with an accuracy of 1 mm. The snooker dynamical parameters are measured using successive ball locations. The coefficients of friction for sliding and rolling were determined. The influence of the cushion on the ball was investigated for hits parallel to the cushion. After an oblique collision, separation angles and velocities were observed and compared to predictions. Our measuring method is an easy, dependable, quick, and nonintrusive approach that may be utilized to examine the many hypotheses on the dynamics of the pool. The study conducted by Izrailev et al. [2] examined the eigenstate scarring process in rectangular cues with surfaces that are somewhat corrugated and showed that it is very different from Sinai and Bunimovich cues. We provide evidence that two types of scar states occur. The ball-bouncing pathways in the corresponding classical billiard configuration space are linked to one set. In the momentum space, a second set of scar-like states arises from the plane-wave states of the unperturbed flat billiard. In the case of billiards, the numerical findings demonstrate that eigenstates are repulsive to a single rough surface. Repulsion is either amplified or removed depending on whether two horizontal rough surfaces are symmetric or antisymmetric. Since repulsion has a strong influence on the structure of all eigenstates and affects the scattering of electromagnetic (or electron) waves via quasi-one-dimensional waveguides, the symmetric features of the rough profiles are important. Consequently, the analysis is carried out in terms of a two-particle basis, and the billiard boundaries' roughness is mitigated by utilizing the potential's complexity.

In the experiment carried out by Doménech et al. [3] The oblique impact of a cue ball traveling on a horizontal surface with any spin and an object ball at rest is represented by the independent friction-restitution modeling of impact. 'Constant' normal restitution, tangential restitution, and friction coefficients are used in the model to provide theoretical formulations for the post-collision linear and angular velocities for both stick and slide regimes of impact. The model also predicts the balls' post-impact velocities when the pure rolling motion is caused by friction with the supporting surface. Experimental data and theoretical predictions for collisions with steel, brass, rubber, and conventional billiard balls match well. The experiment conducted by Pasquero et al. [4]The study of impacts between rigid bodies may be effectively applied to some recent general theoretical conclusions on impacts of mechanical systems with unilateral limitations This is derived by using differential geometric impulsive mechanics. Discussing further the application of these geometric approaches to collisions involving rigid bodies in a broader context. The aim was to analyze the effects of two equal billiard balls traveling on the plane in all conceivable ideal circumstances. This includes when the balls can freely glide or roll on the billiard's plane and between themselves. In both cases, the general parts of the algorithm are presented and implemented. To overcome the computing challenges brought on by the system's numerous degrees of freedom, symbolic computation software is a must. With given pre-impact locations and velocities, it enables the acquisition of precise expressions for the linear and angular post-impact velocities of the balls, providing a comprehensive quantitative and qualitative study of any specific ideal impact. The research carried out by Haar.S et al.[5] The neurobehavioral systems underlying human motor control and learning evolved in free-acting, natural settings, but these are mostly studied in reductionist lab-based research. Here, we go towards more applied motor neuroscience by utilizing wearables to capture realistic full-body action during a skill-development exercise centered around pool billiards. Initially, we looked at the transferability of established features of motor learning from laboratory trials to real-world tasks. Many factors were similar, such as different learning rates and the relationship between task-related variability and motor learning. There are three key ways in which our data-driven technique reveals- the structure and complexity of movement, variability, and motor learning. These contribute to a comprehensive understanding of the structure of motor learning. First, we find that motor learning affects the entire body, changing motor control from head to toe. This is in contrast to assumptions that the arm carrying the cue can accomplish most of the movement. Second, every person experienced a reduction in movement and variability in results. After learning, participants with higher levels of variability remained so. Lastly, when examining the link between starting variability in certain joints and learning across individuals, we found that only the initial variability in the right forearm supination exhibits a meaningful association with the participant's learning rates. This is in accordance with the relationship between variability and learning, which demonstrates that although learning typically lowers variability in movement, the rate at which learning takes place is solely dependent on the initial variability in the specific task-relevant dimensions.

3. Proposed Methodology

The solenoid motor is the engine of the system, and its significance cannot be overstated. Its primary function inside the snooker table mechanism is to provide a steady and controlled stroke to the cue ball. By translating into mechanical action, the cue stick becomes an effective piston. In snooker, one of the biggest challenges is to make a steady, predictable hit on the cue ball. Power, skill, and even minute variations in the cue stick's handling are among the several factors that are taken into consideration. Due to the unpredictability and uneven nature of these elements, playing at a high level of skill may be challenging. In this case, the solenoid motor becomes revolutionary. When a player lines up a shot and, in a sense, "pulls the trigger," the solenoid motor turns on. It ensures that the force applied to the cue ball is consistent from shot to shot by causing the cue stick to advance with a precise and controlled motion. This is an important benefit since it fully removes the influence of external factors such as the player's skill level or physical capabilities. Imagine a scenario where two players with different ability levels attempt the same shot. The result may have been much different in the absence of the solenoid motor due to the fluctuating force applied. However, since the solenoid motor maintains the force constant, both players may receive the same results when it is incorporated. This kind of consistency is essential in snooker, where precision and accuracy are vital. The consistent behavior of their strokes must give players confidence.

The solenoid motor ensures that the cue ball will react as anticipated whether they are trying a light tap or a strong break. Additionally, the constant force output of the solenoid motor gives gamers a plethora of options. They are able to use a variety of techniques with assurance since they know the motor's dependable performance has their back. The solenoid motor equips players to experiment with various techniques and consistently generate precise shots, from delicate finesse shots to forceful strokes.

Number of Snooker Table	Distance covered by the balls
Snooker Table 1	22.8 m
Snooker Table 2	14.4 m
Snooker Table 3	19.45 m
Snooker Table 4	7.20 m

Table 1. Distance covered by the balls which are hit by constant force

If we observe the above table we can see that **Table 4** has more resistance to the constant force because it has been used for more than 15 years. The 2nd table had a different cloth in it which was Strachan which has resistance in it. The 3rd table was used frequently and the cloth used in it is baize hence the 19.45 m. The first table has been used for 6 years, the table is frequently maintained and taken care of.

Fig 2. Dimensions of Snooker Table(Image credits:https://www.snookercentral.com/snooker-table-size)

4. Results

In the snooker shots, I used a cue stick attached to a solenoid motor to apply a steady and uniform force to the cue ball and used the same cue stick to hit the balls with a constant level of force across several snooker tables in the project, and the results are shown in (Table 1). It's interesting to see that Snooker Table 4 offered more resistance than Snooker Table 1 did when both tables were exposed to the same continuous cue stick power.

5. Conclusion

The complex world of snooker explores the role of the solenoid motor and offers concrete examples of how it affects games. By assuring reliable and consistent strokes, understanding and utilising the solenoid motor's potential may revolutionise snooker gameplay and add to the attractiveness of this enthralling sport. In conclusion, the solenoid motor has enormous potential to completely transform the snooker industry. It gives players the ability to execute shots with consistency and dependability, which allows them to advance their accuracy and expertise. This therefore adds to the sport's allure for participants and onlookers alike. The solenoid motor is a symbol of advancement and a sign of the sport's bright future as snooker and technology continue to grow together.

References

1. Mathavan, Senthan & Jackson, M. & Parkin, Robert. (2009) Application of high-speed imaging to determine the dynamics of billiards American Journal of Physics - AMER J PHYS. 77. 10.1119/1.3157159.
2. Izrailev, F. M., A., G., & A., J. (2023). Scarring in Rough Rectangular Billiards *Entropy*, *25*(2), 189. https://doi.org/10.3390/e25020189
3. Doménech-Carbó, A. (2023). Independent friction-restitution description of billiard ball collisions. Mechanics Research Communications, 131, 104149. https://doi.org/10.1016/j.mechrescom.2023.104149
4. Pasquero, Stefano. “A computer-assisted geometric approach to the analysis of the impact of billiard balls. Part I: Ideal impacts" Journal of Engineering Mathematics 69 (2011): 373-384.
5. Haar, S., Van Assel, C. M., & Faisal, A. A. (2020). Motor learning in real-world pool billiards Scientific Reports, 10(1), 1-13. https://doi.org/10.1038/s41598-020-76805-9