Research on the Technology of Intelligent Basketball Shooting Training Vehicle

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Abstract. The basketball training car only has the function of storing basketballs and training equipment. During training, the basketball is taken out of the training car and scattered on the ground. The athlete needs to bend down to pick up the ball for shooting training, which is not conducive to the continuity of shooting action training, and affects the intensity of shooting training and the shooting accuracy improvement. It is necessary to manually place the basketball on the swing seat, it can not be automatically served, and the function is low. Therefore, this article conducts technical research on the basketball shooting training vehicle, and sets up a telescopic motor to drive the upper tee to move up and down and other technical studies, in order to intelligently upgrade the existing shooting training vehicle, which is conducive to the continuity of shooting action training and the intensity of shooting training, can improve the fixation of the shooting hand and improve the shooting percentage.

Keywords: Intelligence, Basketball, Shooting, Technical Research

1. Introduction

With the rapid development of artificial intelligence technology, sports equipment has also ushered in earth-shaking innovation. Basketball is a popular and wide-ranging sport, and its training equipment is bound to arouse people's attention. The competition of modern sports is becoming increasingly fierce. It is difficult for various countries and regions to keep certain secrets in training methods. The improvement of competitive ability and the outcome of the game are often caused by the inadequate training equipment. As the main scoring method of basketball, shooting takes an important position in the entire basketball game. So how to improve the basketball hit rate has become the center of training and competition. And to improve the basketball hit rate, one of the important factors is to increase the number of shots in training and games, the increase in the number will greatly increase the chance of hit. Therefore, this article combines artificial intelligence technology to conduct technical research on the basketball shooting training vehicle, which makes the basketball shooting training vehicle intelligent, reduces unnecessary waste of time in training, and increases the number of shots in a fixed time.
2. Mathematical analysis of basketball shooting percentage

Everyone's shot angle and initial speed when shooting a basketball are different. The curve of the ball in the air is also different. The standard basketball diameter d used normally is 24.6 cm, and the diameter D of the standard hoop is 45 cm, from which it is calculated that the largest cross-sectional area of the basketball only accounts for about 30% of the hoop area, and the vertical distance H from the hoop center to the ground court is 3.05 m, the length between the three-point line and the rim L = 4.60 m. Assuming that the height when the basketball is shot is h_m, the initial speed is v_0, and the shooting angle is α, a mathematical model of the basketball player's shooting process can be established, as shown in Figure 1.

![Figure 1. Schematic diagram of the mathematical model of the shooting process](image)

As shown in Figure 1, the initial motion equation of basketball can be established as

\[
\begin{align*}
x &= v_0 \cdot t \cos \alpha \\
y &= v_0 \cdot t \sin \alpha - \frac{gt^2}{2}
\end{align*}
\]

After the joint, the expression of the basketball in the entire running process from throwing to falling to the rim is:

\[
y = x \cdot \tan \alpha - \frac{gx^2}{2v_0^2} \sec^2 \alpha
\]

From the model diagram, the necessary conditions for a basketball hit are: when x = L, y = H-h. However, if you want to hit the basketball accurately, you need to analyze and consider the obstruction of the side of the basket, that is, the angle of the basketball into the frame is greater than a certain value, the condition of this part is

\[
D \cos(90^\circ - \beta) \geq d
\]

When x = L, the expression is

\[
\tan \beta = -\frac{dy}{dx}
\]

3. Use intelligent basketball shooting training vehicle to improve the efficiency of shooting training

In order to effectively break through and improve the basketball hit rate, athletes will focus on training path planning skills. When shooting, you need to plan the basketball route to make the flying parabola more reasonable. When there is no hit, you need to determine the rebound point according to the preset route in order to track and compete for the rebound time. In practice, athletes first observe the situation on the field and then look for information. Time is a key issue, and being able to fight for sufficient shooting time and frequency is one of the main ways to effectively improve the shooting percentage of basketball players. Through comprehensive analysis and classification of information, the use of thinking processes to form decisions and obtain planning routes. Based on the mathematical analysis of shooting, this paper conducts technical research on the intelligent basketball shooting training vehicle, and sets up a telescopic motor to drive the upper tee to move up and down and other
technical research, in order to intelligently upgrade the existing shooting training vehicle. It is conducive to the continuity of shooting action training and the intensity of shooting training, which can improve the fixation of shooting hands and the improvement of shooting accuracy.

4. Technology construction of intelligent basketball shooting training vehicle

4.1. Working principle

According to the principle of practicability, the basketball shooting training vehicle must have the basic functions of walking, steering, conveying and improving basketball. Therefore, the composition of the basketball robot should include the conveying mechanism, walking mechanism, lifting mechanism, control mechanism and power device. The overall structure produced by this study is shown in Figure 123. In order to reduce weight and ensure the strength and rigidity of the overall structure, The basketball is placed in the ball storage room 21 during the training. Since the inclined bottom plate 7 is installed inside the car shell 2, the basketball can be sent into the first upper ball groove 24 and the second upper ball groove 25, and the basketball can pass the first The upper ball hole 26 and the second upper ball hole 23 enter the swing ball seat 3, and the upper ball seat 3 is driven up and down by the telescopic motor 4 to move up and down, which can feed the basketball in the ball storage room 21 into the swing ball seat 3, which is beneficial to The continuity of shooting action training and the intensity of shooting training can improve the fixation of the shooting hand shape and the improvement of the shooting accuracy. By installing the clothes rails 9 at both ends of the car shell 2, the clothes can be hung for better performance Shooting training improves the diversity of functions.

4.2. Overall design

The intelligent basketball shooting training vehicle includes a base, a car shell, a telescopic motor, an upper tee, a tilted bottom plate and a clothes rail, a car shell is installed on the upper side of the base, and swing ball seats are installed on both sides of the car shell , a first guardrail is installed outside the upper end of the swing ball seat, and one end of the swing ball seat is inclined downward, one end of the swing ball seat is installed with a goal opening, and an inclined bottom plate is installed inside the vehicle housing a tapered plate is installed at one end of the bottom plate, and a first upper ball groove and a second upper ball groove are respectively opened on both sides of the tapered plate, and the vehicle shells outside the first upper ball groove and the second upper ball groove are opened. There is a first upper ball hole and a second upper ball hole, a telescopic motor is installed on the lower side of the base, a telescopic rod is connected to the upper side of the telescopic motor, and an upper ball seat is installed on the top of the telescopic rod, and the upper ball seat a second guardrail is installed at the periphery of the upper end, and clothes rails are installed at both ends of the vehicle shell. The upper tee is inclined, and an opening corresponding to the goal opening is provided on one side of the upper tee; a ball storage room is provided inside one side of the vehicle shell, and a door is installed at one end of the ball storage room; the base a supporting foot is installed on the lower side, and a walking wheel is installed on the lower side of the supporting foot, a push-pull handle is installed on one end of the base; The height is lower than the height of the goal opening; the telescopic motor and the upper ball seat are installed symmetrically about the bottom of the car shell.

As shown below: 1-base, 11-push handle, 2-car shell, 21-ball storage room, 22-door, 23-second upper ball hole, 24-first upper ball slot, 25-second Upper ball slot, 26-first upper hole, 3-swing tee, 31-first guardrail, 32-goal opening, 4-telescopic motor, 41-telescopic pole, 5-upper tee, 51-second Guardrails, 6-stoppers, 7-tilt
Figure 2. Front view of the overall structure

Figure 3. A top view of the overall structure

Figure 4. Schematic diagram of the structure inside the car shell

Compared with the prior art, the upper tee is driven by the telescopic motor to move up and down, and the indoor basketball can be sent to the swing tee, which is conducive to the continuity of shooting action training and the intensity of shooting training, which can improve the shooting hand type. The fixing of the ball and the improvement of the shooting accuracy rate are achieved by installing clothes rails at both ends of the car shell, which can be used for hanging clothes, which is better for shooting training, and improves the diversity of functions. The feet are installed on the lower side of the base, and a walking wheel is installed on the lower side of the foot, which is convenient for pushing the vehicle shell to move and walk.

4.3. Walking mechanism

The walking mechanism uses two driving wheels and two following wheels. Considering the turning of the basket or left or right, the two driving wheels are driven by independent motors and speed
reducers, respectively. The transmission wheel and the driven wheel use rubber wheels, and the reducer has a relatively large transmission. A heavy battery is placed near the transmission wheel to increase the positive pressure between the transmission wheel and the ground to achieve flexible movement. At the same time, a new type is set between the driving wheel and the following wheel. The nano material conveying device makes the whole light, convenient and easy to operate.

4.4. Conveying mechanism
The function of the conveying mechanism is to convey the basketball from the ball storage box to the ball storage platform mechanism. It is mainly composed of a ball receiving mechanism, a lifting mechanism and a ball guiding mechanism. The ball collecting mechanism is mainly composed of a motor, a reducer and a sponge roller. Its main function has two aspects: one is to block the basketball in the ball warehouse, do not allow the basketball to roll into the lifting mechanism at will; send it into the lifting mechanism. The receiving mechanism is controlled remotely by the operator according to actual needs. In order to prevent sending to multiple ball cranes at the same time, causing a "trapped" state, the speed of the sponge roller of the ball should not be too high, and the distance from the sponge roller from the bottom of the storage bin must be appropriate. The lifting mechanism is mainly composed of a motor, a reducer, a belt drive, a dribble, and a ball receiver. Its main function is to lift the basketball from a lower position to a suitable height, thereby "loading" the bomb storage platform mechanism. The ball guide rail mechanism is mainly composed of a ball guide rail, a ball loader and a motor. It has three main functions: one is to guide the ball, even the launching mechanism of the basketball rolling to the entrance; the second is to store the ball (can store 5) to reduce the auxiliary time for transferring the basketball and improve the shooting speed; the third is to "reload" Launching agency. In order for the basketball to roll freely on the fairway with its own weight, each part of the fairway has an appropriate slope. The ball loading machine has the function of blocking the next basketball when loading the ball into the launching mechanism, preventing multiple loading or jamming of the ball. The ball loading machine works reliably, flexibly and with high precision. In order to improve the conveying speed, a ball mechanism and a lifting mechanism are used between the automatic control systems, that is to say, when the operator sends a ball with an electrical signal to pass the remote control, the ball ball mechanism moves from the bottom of the storage silo (ball storage silo) The surface is opened by the lowest ball) take out a ball. When the ball rolls into the ball curtain at the bottom of the spreader, the ball comes into contact with the travel switch that sends the lifting signal, the spreader starts to lift, and the ball will be lifted. When the ball is lifted up by the entrance fairway (at this time, the ball is lifted into the entrance fairway ball receiver), the ball is dried again and touches a stroke switch, a signal of descent is issued, and the ascent and descent drop rapidly when the dribble is the bottom, then touch a travel switch, send out the ball signal, the ball will automatically mechanism. Ride back and forth until the fairway is "full".

5. Specific implementation methods of intelligent basketball shooting training vehicle
Combined with the above illustrations, the technical solution of the intelligent basketball shooting training vehicle is clearly and completely described: including the base 1, the car shell 2, the telescopic motor 4, the upper tee 5, the inclined floor 7 and the clothes rail 9, the base 1 a car shell 2 is installed on the upper side, and pendulum tees 3 are installed on both sides of the car shell 2 for placing basketballs, which is convenient for shooting training. A first guardrail 31 is installed on the outer side of the upper end of the pendulum tee 3, and a pendulum tee One end of the 3 is inclined downwards, a ball opening 32 is installed at one end of the swing tee 3, an inclined bottom plate 7 is installed inside the car shell 2, and a tapered plate 71 is installed at one end of the inclined bottom plate 7 to facilitate the movement of the basketball to the one end of the car shell 2, The first upper ball groove 24 and the second upper ball groove 25 are respectively opened on both sides of the tapered plate 71, and the first upper ball is opened on the vehicle shell 2 outside the first upper ball groove 24 and the second upper ball groove 25 The hole 26 and the second upper ball hole 23 are convenient for basketball discharge. The bottom side of the base 1 is equipped with a telescopic motor 4. The telescopic motor 4
is connected with a telescopic rod 41 on the upper side, and an upper ball seat 5 is installed on the top of the telescopic rod 41. A second guard rail 51 is installed at the periphery of the upper end of the seat 5, and a clothes rail 9 is installed at both ends of the vehicle housing 2 to hang clothes. The upper tee 5 is inclined and the side of the upper tee 5 is provided with an opening corresponding to the goal opening 32, so that the basketball placed on the upper tee 5 can enter the swing tee 3. A ball storage room 21 is provided inside one side of the vehicle housing 2, and a door 22 is installed at one end of the ball storage room 21 to facilitate storage of basketballs and basketball training equipment. The base 1 is provided with a supporting foot 81 on the lower side, and a walking wheel 8 is mounted on the lower side of the supporting foot 81, and a push-pull handle 11 is installed on one end of the base 1 to facilitate the vehicle case 2 to move and walk. A ball baffle 6 is installed on the outer side of the vehicle shell 2 between the swing ball seat 3 and the upper ball seat 5, and the height of the ball fence 6 is lower than the height of the goal opening 32, which is convenient for placement on the upper ball seat 5. Of the basketball enters the swing tee 3. Two telescopic motors 4 and upper ball seats 5 are installed symmetrically with respect to the bottom of the car shell 2 to enable basketball training in two directions at the same time.

6. Conclusion

In order to improve the efficiency of basketball shooting training and the ability of athletes to respond to the basketball court, the basketball training strategy introduces an intelligent basketball shooting training vehicle. Through high-tech intelligent equipment, the number of basketball players’ fixed-time shooting training is increased to improve training efficiency and level. The technical solution is introduced into the ordinary basketball equipment storage vehicle, which makes the ordinary basketball storage vehicle intelligent and multi-functional, so that the athlete has a faster basketball shooting target capturing ability and a faster response speed, thereby improving the basketball shooting rate. Finally, combined with the practice of shooting training to verify the operation ability and efficiency of the intelligent basketball shooting training vehicle, effectively improve the athlete’s shooting percentage.

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