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Design and Fabrication of an Automated Football Shooting Machine

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Abstract: ***The growing demand for consistent and efficient football training has highlighted the limitations of manual practice methods in terms of repeatability, accuracy, and player workload. This study presents the design and fabrication of an automated football shooting machine capable of delivering controlled shots with adjustable speed, angle, and trajectory. The system integrates a motor-driven dual-wheel mechanism with a programmable control unit to replicate real-game shooting conditions. Emphasis is placed on mechanical stability, energy efficiency, and adaptability for different training scenarios. Unlike conventional ball launchers, the proposed design focuses on modular construction and cost-effective components, making it suitable for academic and grassroots-level applications. Experimental validation demonstrates reliable performance in terms of shot consistency and directional control. The developed prototype offers a practical solution for improving player reflexes, goalkeeping skills, and shooting accuracy, while also serving as a scalable platform for future automation and robotics-based sports training systems.***

Keywords: Automated football shooter, ball launching mechanism, dual-wheel system, sports automation, training equipment, DC motor control, trajectory adjustment, mechanical design, sports robotics, skill enhancement

I. INTRODUCTION

In modern sports training, automation is increasingly being adopted to improve performance, consistency, and efficiency. Football training, particularly shooting and goalkeeping practice, requires repetitive and accurate ball delivery, which is difficult to achieve manually. Variations in human effort often lead to inconsistent speed, direction, and frequency of shots.

To address these limitations, the development of an automated football shooting machine provides a reliable solution. This project focuses on designing a compact and cost-effective system capable of launching footballs with controlled velocity and adjustable angles. The machine uses a motorized mechanism to simulate real-game shooting conditions, enabling players to train more effectively. The proposed system not only enhances training quality but also reduces dependency on additional players or coaches. It is especially useful for individual practice sessions, football academies, and educational institutions. Furthermore, the project introduces concepts of automation, mechanical design, and control systems, making it relevant for engineering applications.

II. LITERATURE SURVEY

Research on automated sports training equipment has been widely explored by several researchers in recent years.

1) Kumar et al. (2020) studied the design of a ball launching mechanism and concluded that motor-driven roller systems provide better consistency in ball speed and direction compared to manual training methods. Their work highlighted the importance of controlled training environments for improving player accuracy.

2) Sharma et al. (2022) investigated automated football shooting machines with adjustable angle and speed control. Their study demonstrated that variable shooting parameters help simulate real match situations, thereby improving reaction time and decision-making ability of players.

3) Patel and Mehta (2021) focused on the mechanical design aspects of ball launching systems. They emphasized the need for a stable frame structure and proper alignment of rollers to achieve uniform ball trajectory. Their findings also suggested that vibration reduction plays a key role in maintaining shooting accuracy.

4) Singh et al. (2023) worked on integrating microcontroller-based automation in sports training equipment. Their research showed that using embedded systems allows precise control over motor speed and shooting intervals, enhancing repeatability and system efficiency.

5) Verma et al. (2021) analyzed different motor types used in automated machines and concluded that DC motors with variable speed control are more suitable due to their flexibility, energy efficiency, and ease of control.

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III. METHODOLOGY

The methodology adopted for the design and fabrication of the automated football shooting machine is divided into systematic stages to ensure efficient development, testing, and performance evaluation of the system.

A. Problem Identification

The first step involved identifying the limitations of traditional football training methods, such as inconsistency in ball delivery, dependency on human effort, and lack of repeatability. The need for an automated system capable of delivering controlled and consistent shots was established.

B. Concept Development

Different mechanisms such as pneumatic systems, spring-based launchers, and roller-based systems were studied. Based on simplicity, cost, and efficiency, a dual-wheel (roller) mechanism was selected for the design due to its ability to provide continuous and controlled ball shooting.

C. Design and Modeling

The mechanical structure of the machine was designed using CAD software (SolidWorks/AutoCAD). The design included:

- Frame structure
- Roller arrangement
- Motor mounting system
- Ball feeding mechanism
- Adjustable angle setup

D. Fabrication Process

The fabrication involved:

- Cutting and welding of frame
- Mounting of motors and rollers
- Alignment of shafts and bearings
- Installation of electrical connections

Proper alignment and balancing were ensured to reduce vibration and improve efficiency.

E. Working and Operation

The machine operates by feeding the football between two rotating rollers. The friction between the rollers and the ball accelerates it forward, resulting in a shooting action. The speed of the ball is controlled by varying motor speed, while the shooting angle is adjusted by tilting the frame.

F. Testing and Validation

The prototype was tested under different conditions:

- Varying motor speeds
- Different shooting angles
- Repeated trials for consistency

Performance parameters such as shooting distance, accuracy, and repeatability were observed and analyzed.

G. Performance Evaluation

The system performance was evaluated based on:

- Consistency of shots
- Stability of machine
- Ease of operation
- Cost-effectiveness

The results confirmed that the machine provides reliable and efficient football shooting for training purposes.

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IV. DISCRIPTION OF COMPONENTS

A. DC Motors

DC motors are used to drive the rollers. They convert electrical energy into mechanical rotational motion. The speed of the motors can be controlled using a speed controller, which directly affects the velocity of the football.



Fig 4.1 DC Motor

Power	250W
Speed	2650 RPM
Torque	0.9 N.m
Rated voltage	24V DC

Table 4.1 Specification of Motor

B. Rubber Wheels

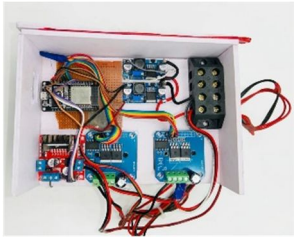
Rubber wheels are used to grip and accelerate the football. They are connected to motors and rotate at high speed. When the ball passes between two rubber wheels, friction pushes it forward, resulting in shooting.



Fig 4.2 Rubber Wheels

C. Speed Controller

A speed controller (such as a motor driver or regulator) is used to vary the speed of the motors. By adjusting the speed, the velocity of the ball can be controlled.



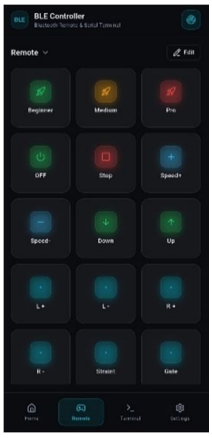


Fig 4.3 Speed Controller

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D. Football

A football is a spherical ball made of synthetic leather panels with an air-filled rubber bladder inside, which helps maintain its shape and pressure. A standard Size 5 football has a circumference of about 68–70 cm and weighs around 410–450 grams.



Fig 4.4 Football

V. FABRICATED MODEL





VI. RESULTS

The fabricated automated football shooting machine was successfully tested under different operating conditions. The system demonstrated effective performance in terms of ball launching, consistency, and control.

During testing, it was observed that the machine was capable of projecting the football to a considerable distance with stable speed and direction. By varying the motor speed, the velocity of the ball could be controlled efficiently. Similarly, adjustment in the frame angle allowed variation in the trajectory of the ball.

The dual-wheel mechanism provided good grip on the football, resulting in minimal slippage and smooth shooting action. Repeated trials showed that the machine maintained consistency in ball delivery, which is essential for training purposes.

The structure remained stable during operation, and vibrations were within acceptable limits. The machine also proved to be easy to operate and required minimal human effort.

VII. CONCLUSION

The automated football shooting machine was successfully designed and fabricated using a dual-wheel mechanism. The system is capable of delivering footballs with controlled speed, direction, and good consistency. It reduces the need for manual effort and allows repetitive practice, which is important for improving player skills such as shooting accuracy and goalkeeping.

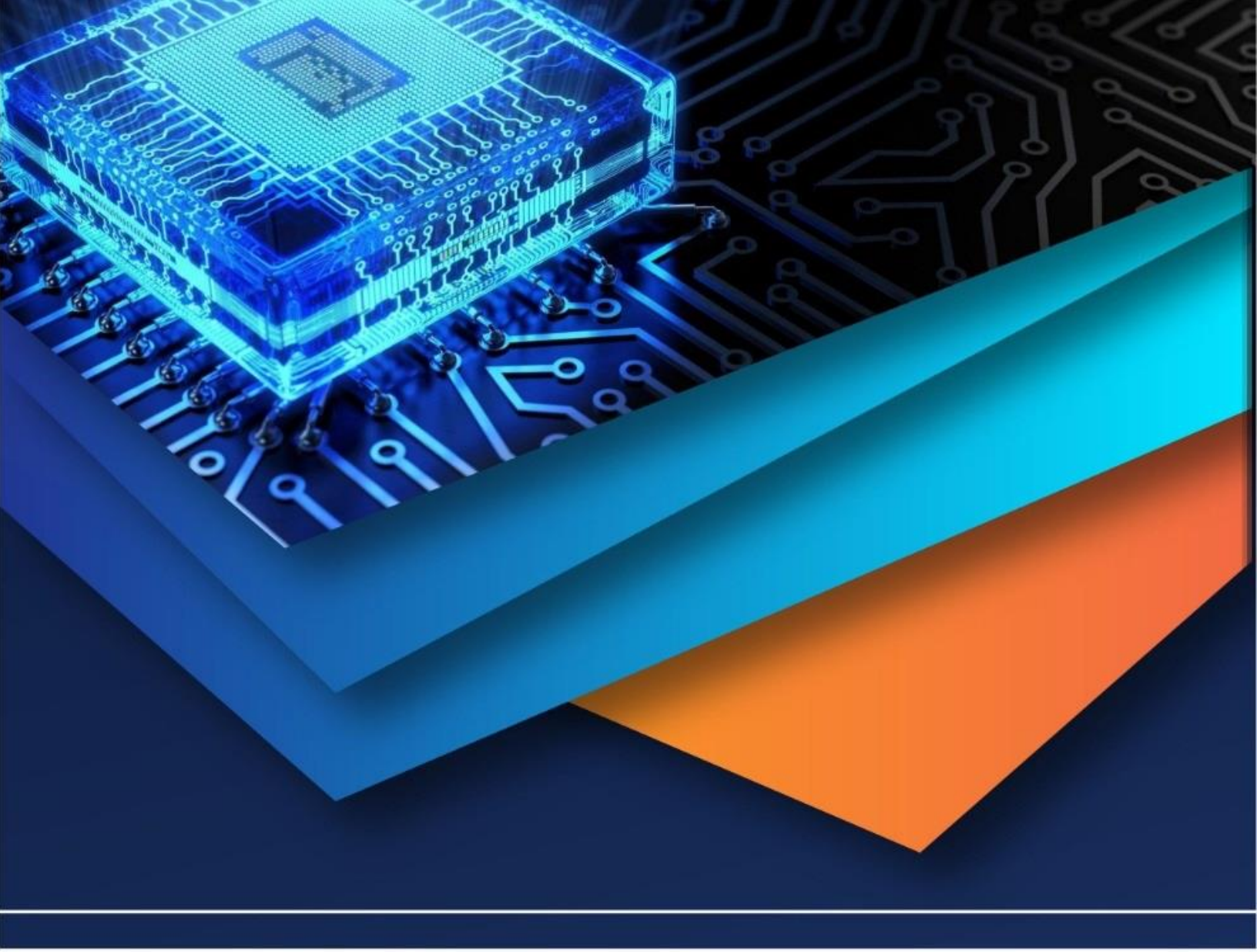
The machine is simple in design, cost-effective, and easy to operate, making it suitable for training academies and educational purposes. Overall, the project meets its objectives and demonstrates the effective use of mechanical systems and automation in sports training.

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