# Fabrication of Soccer and Cricket Ball Launching Machine

I.Raghuram[1], G.Jaya Surya[2], P.Joseph[3], Ch.Vijaya Krishna Rao[4] and B.Susmitha[5]

[1]Student, Andhra Loyola Institution of Engineering and Technology, INDIA
[2]Student, Andhra Loyola Institution of Engineering and Technology, INDIA
[3]Student, Andhra Loyola Institution of Engineering and Technology, INDIA
[4]Student, Andhra Loyola Institution of Engineering and Technology, INDIA
[5]Assistant Professor, Andhra Loyola Institution of Engineering and Technology, INDIA

[1]Corresponding Author: raghuraminturi4484@gmail.com

## ABSTRACT

There are so many famous games in the world. In that, soccer and cricket are the two famous games played by a team of members. Now a day's school/college/university doesn't have sufficient trainers to train the students in respective sports like soccer and cricket. Even though they have trainers they don't have sufficient time to train the individual students in specific field at a time.

For this reason, our paper focus on introducing a launching machine known as soccer & cricket ball launching machine to train the goal keeper by himself in ground without help of a trainer or any other person So by using this machine we can give training to their students in respective field of sports like soccer and cricket. This machine throws the balls automatically at different suitable adjustable speeds. "Launching of the ball in horizontal and vertical planes and in trajectory motions using aerodynamic and mechanical principals". This machine is useful in both games and also machine works efficiently in their practice.

While using this machine we can save the time for trainers because the balls are thrown automatically and also students who are using this machine do practice efficiently when compared to the trainer training the students. And also, this single machine plays a major role for practicing in both soccer and cricket sports.

*Keywords--* Motor, Soccer, Cricket Balls

## I. INTRODUCTION

The world of sports has always been a source of excitement and entertainment for people of all ages. Among the most popular sports are soccer and cricket, which require a lot of skill, strategy, and practice to master. One of the challenges in these sports is developing the necessary strength and accuracy to launch the ball with precision.

To help players improve their skills, engineers and designers have developed a sophisticated machine that can launch soccer and cricket balls with precision and consistency. This machine, called the Soccer and Cricket Ball Launching Machine, is designed to help players practice their shots and develop their skills in a controlled environment.

The Soccer and Cricket Ball Launching Machine is a sophisticated device that uses advanced technology and engineering to launch balls at varying speeds, angles, and distances. The machine consists of a sturdy base, a launching mechanism, and a control panel that allows users to adjust the settings of the machine according to their needs.

The launching mechanism of the machine is designed to accommodate different types of balls, including soccer and cricket balls of various sizes and materials. The machine can launch balls at speeds ranging from slow to very fast, depending on the user's preference.

The control panel of the machine allows users to adjust the settings of the machine according to their needs. Users can adjust the speed, angle, and distance of the ball's launch, allowing them to practice a wide range of shots and techniques. The machine can also be set to launch balls at random intervals, simulating real game scenarios and adding an element of unpredictability to the practice session.
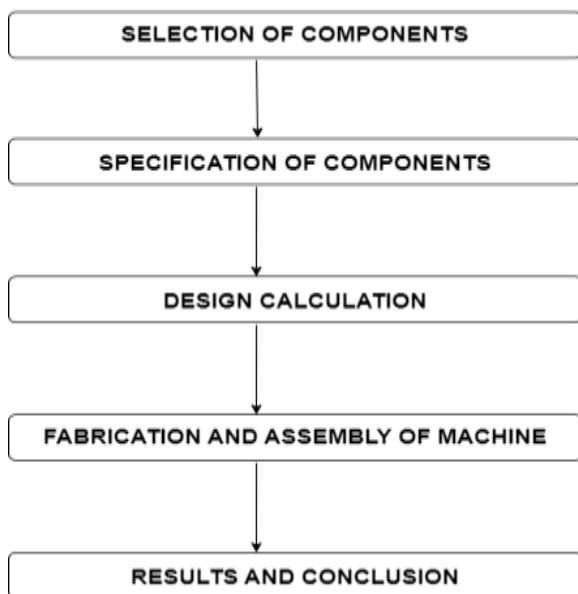
The Soccer and Cricket Ball Launching Machine is a valuable tool for coaches, trainers, and players looking to improve their skills and performance in soccer and cricket. By providing a controlled and consistent environment for practice, the machine allows players to focus on developing their technique and strategy, without the distractions and variables of real game situations

## II. LITERATURE SURVEY

Invented an A.C electric motor Soccer shooting machine. They focused on the electricity used to run the A-C electric motor and modified into the manual operating shooting machine in the absence of electricity. **A. sathiyaseelan et al [1]** the study includes the replacement of manually operated control system with an electrical

operating. This includes the usage of automation technology like PLC, HMI and screen design. To avoid the inconvenience of the electric system ac current is converted into DC current. **Mahesh Kumar Gupta et al [2]** according to the paper and volley ball practice machine was fabricated for the launching of the ball in horizontal and vertical planes and in trajectory motions using aerodynamic and mechanical principles. For imparting translation and rotational motions with spin to counter rotating wheel mechanism is used. For designing this machine manual calculations solid works and AutoCAD designs were involved. **Perumal Samy et al [3]** the study includes the design of a machine which throws the ball automatically with different speeds for cricket practice. Many mechanical and electrical parameters were involved for designing this cheapest ball pitching system. **V. Tiwari Pratik et al [4]** the study involves the manufacturing of football launcher with locally available material and a universal joint. Since the material are available locally the design is economical. By adjusting the universal joint, the angle of the ball will be varied which intern varies the speed of the ball any fielder can practice football using this football launching machine **Paresh Sawai et al [5]** The ball projecting machine which imparts swing and spin to the ball was design and fabricated in this journal. Warm gears were used for swinging whereas the motors were fixed at different speeds which helps the ball to spin for varying the wheels gap motor plate was mode toluide with the help of screws and nuts various types of balls will be projected using in this machine with changing the line and length of the ball. **Abhishek Pratap singh et al [6]**

## III.    DESIGN PROCEDURE

SELECTION OF COMPONENTS
↓
SPECIFICATION OF COMPONENTS
↓
DESIGN CALCULATION
↓
FABRICATION AND ASSEMBLY OF MACHINE
↓
RESULTS AND CONCLUSION

## IV.    SELECTION OF COMPONENTS

The following components are used for fabrication of soccer ball launching machine:

| $s_{no}$ | Name of component | Specification | Number |
|---|---|---|---|
| 1 | Dc motor | Voltage – 24v | 2 |
| 2 | Rotating wheels | Diameter-23cm | 2 |
| 3 | Battery | Voltage – 12v | 2 |
| 4 | Led screws | Length – 30cm | 2 |
| 5 | Frame | Length – 106cm | 1 |
| 6 | Caster wheels | Diameter-12mm | 4 |
| 7 | Handle | Diameter of the rod 20mm | 1 |

## V.    SPECIFICATIONS OF COMPONENTS

*DC Motors*

A DC (direct current) motor is a type of electric motor that converts electrical energy into mechanical energy. A DC motor can be used in a soccer and cricket ball launching machine to provide the rotational motion needed to launch the soccer and cricket ball. In a soccer and cricket ball launching machine, the DC motor is typically connected to rotating wheel that transfer the rotational motion to a mechanism that launches the soccer and cricket ball.



**Figure 1**

Modal      -   MY1016
Voltage    -   24V DC
Rated speed  -   2650rpm
Output     -   250w

*Rotating Wheels*

Rotating wheel can be used in soccer and cricket ball launching mechanism to impart a spin on the ball as it is launched. This spin can be used to add additional curve or swerve to the ball's flight path, making it more difficult for the goal keeper and fielders to stop.

**Figure 2**

| | | |
|---|---|---|
| Material | - | plastic |
| Diameter | - | 23cm |
| Weight | - | 300g |

### *Battery*

A battery is a device that stores and converts chemical energy into electrical energy. It typically consists of one or more electrochemical cells, which contain positive and negative electrodes, an electrolyte that allows ions to move between the electrodes, and a separator that prevents the electrodes from coming into contact. In the context of launching a soccer and cricket ball, batteries might be used to power motors or other components that provide the necessary force to propel the ball.



**Figure 3**

| | | |
|---|---|---|
| Modal | - | sealed lead-acid rechargeable battery |
| Voltage | - | 12v |
| Current | - | 2.25A |

### *Lead Screw*

A lead screw is a type of mechanical screw that is often used in linear motion applications to convert rotational motion into linear motion. The soccer and cricket ball would be placed on a platform that is threaded onto the lead screw, and as the screw rotates, the platform would move left or right, depending on ball diameter.



**Figure 4**

| | | |
|---|---|---|
| Length | - | 30cm |
| Diameter – | | 0.20cm |

### *Frame*

To design a frame for launching a soccer and cricket ball using mild steel, several factors need to be considered, such as the size and weight of the ball, the required launch speed. The frame should be designed to withstand the stresses and forces generated during the launch process. Mild steel is a popular choice for structures due to its high strength and durability, so it is a suitable material for this application. The size and shape of the frame will depend on the size of the soccer and cricket ball and the desired launch trajectory.
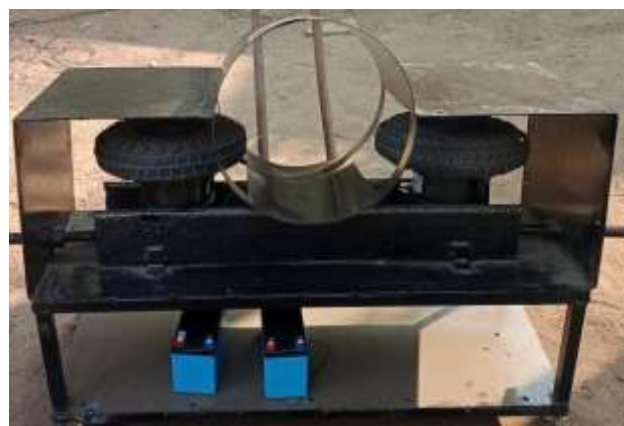


**Figure 5**

| | | |
|---|---|---|
| Length | - | 106cm |
| Width | - | 30cm |
| Height | - | 30cm |
| Material | - | mild steel |

### *Caster Wheels*

Caster wheels could theoretically be used in a soccer and cricket ball launching mechanism to allow for easier movement of the device, they would not be an essential component of the launching mechanism itself.

**Figure 6**

Diameter - 12mm
Weight - 100g

### Handle

The handle is a crucial component in operating soccer and cricket ball launching machines. When using a soccer ball launcher, the handle is typically used to adjust the trajectory of the ball, as well as the speed and distance it is launched. By turning the handle in one direction, the ball may be launched higher, while turning it in the opposite direction may cause the ball to be launched lower. In addition, the handle may be used to adjust the speed of the ball, with faster speeds requiring more force on the handle. Similarly, in a cricket ball launcher, the handle is used to adjust the direction and speed of the ball.

By turning the handle, the launcher's wheels spin faster or slower, altering the speed at which the ball is launched. Additionally, the handle can be used to adjust the angle at which the ball is released, allowing for greater precision in training exercises. Overall, the handle is an essential component in operating both soccer and cricket ball launching machines, allowing for greater control over the trajectory and speed of the ball.



**Figure 7**

## VI. DESIGN CALCULATION

Power required launching football: -
Football specifications: -

Diameter of the ball ($d_b$)  = 22cm.
Mass of the ball ($m_b$)  = 410g.
Wheel diameter ($d_w$)  = 23cm.
Speed of the motor ( N)  = 2650rpm.
Mass of wheel ($m_w$)  = 300g.

➢ ANGULAR VELOCITY ($\omega$).
$$\omega = 2 \times \pi \times N$$
$$= 2 \times \pi \times 2650$$
$$\omega = 277.50 \text{ rad/sec.}$$

➢ VELOCITY OF THE BALL (v).
$$v = \omega \times r$$
$$= 277.50 \times \frac{0.23}{2}$$
$$v = 31.91 \text{ m/sec.}$$

➢ THE AMOUNT OF KINETIC ENERGY FOR EJECTING THE BALL ($K.E_b$).
$$K.E_b = \frac{m\,v^2}{2}$$
$$= \frac{0.41 \times 31.9^2}{2}$$
$$K.E_b = 208.74 \text{ j/sec.}$$

➢ THE AMOUNT OF ENERGY OF STORED IN A SHOOTING WHEEL ($E_s$).
$$E_s = \frac{I\,\omega^2}{2}$$
$$I = \frac{m\,r^2}{2} \qquad r = \frac{0.23}{2} = 0.115$$
$$= \frac{0.3 \times (0.115)^2}{2}$$
$$I = 1.98 \times 10^{-3} \text{ kg-}m^2.$$
$$E_s = \frac{I\,\omega^2}{2}$$
$$E_s = \frac{1.98 \times 10^{-3} \times 277.50^2}{2}$$
$$E_s = 76.38 \text{ j/sec.}$$

➢ TOTAL POWER = TOTAL ENERGY
TOTAL ENERGY (T.E) = $K.E_b$ + Es
= KINETIC ENERGY+ENERGY OF STORED
= 208.74 + 76.38
T.E = 285.12 j/sec.
POWER (P) = 285.12 w.

This Power is used to throw the ball in a parabolic path.
Power required launching cricket ball: -
Cricket ball specifications: -
Diameter of the ball ($d_b$)  =7.2cm.
Mass of the ball ($m_b$)  = 163g.
Wheel diameter ($d_w$)  = 23cm.
Mass of wheel ($m_w$)  = 300g.
Speed of the motor (N)  = 2650rpm.

➢ ANGULAR VELOCITY ($\omega$).

$\omega = 2 \times \pi \times N$

$= 2 \times \pi \times 2650$

$\omega = 277.50$ rad/sec.

➢ VELOCITY OF THE BALL (v).

v = $\omega \times$r

$= 277.50 \times \frac{0.23}{2}$

v = 31.91 m/sec.

➢ THE AMOUNT OF KINETIC ENERGY FOR EJECTING THE BALL ($K.E_b$).

$K.E_b = \frac{m\,v^2}{2}$

$= \frac{0.163 \times 31.9^2}{2}$

$K.E_b = 82.93$ j/sec.

➢ THE AMOUNT OF ENERGY OF STORED IN A SHOOTING WHEEL. ($E_s$)

$E_s = \frac{I\,\omega^2}{2}$

$I = \frac{m\,r^2}{2}$     $r = \frac{0.23}{2} = 0.115$

$= \frac{0.3 \times (0.115)^2}{2}$

$I = 1.98 \times 10^{-3}$ kg$-m^2$.

$E_s = \frac{I\,\omega^2}{2}$

$E_s = \frac{1.98 \times 10^{-3} \times 277.50^2}{2}$

$E_s = 76.38$ j/sec.

➢ TOTAL POWER = TOTAL ENERGY
TOTAL ENERGY (T.E) = K.E + Es
= KINETIC ENERGY+ENERGY OF STORED
= 82.93 + 76.38
T.E = 159.31 j/sec.
POWER (P) = 159.31 w.

This Power is used to throw the ball in a parabolic path.

# VII. PARABOLIC CALCULATIONS OF THROWING BALLS

MAXIMUM HEIGHT ($H_{max}$)    $= \frac{V^2 sin^2\,\theta}{2g}$

HORIZONTAL RANGE(R)    $= \frac{V^2\,sin(2\theta)}{g}$

TIME OF FLIGHT (T)    $= \frac{2\,V\,sin\,\theta}{g}$

Velocity of the ball (v)    = 31.91 m/sec.

*For a Range of (30 m)*
➢ HORIZONTAL RANGE (R)

Range = $\frac{V^2\,sin(2\theta)}{g}$    Since $(sin^2\theta = 1 - cos2\theta)$

$30 = \frac{31.91^2\,sin(2\theta)}{9.81}$

$\theta = 8.39°$.

➢ MAXIMUMHEIGHT ($H_{max}$)

$H_{max} = \frac{V^2 sin^2\theta}{2g}$

$= \frac{31.91^2\,sin^2(8.39)}{2 \times 9.81}$

$H_{max} = 2.209$ m.

➢ TIME OF FLIGHT (T)

T $= \frac{2\,V\,sin\theta}{g}$

$= \frac{2 \times 31.91\,sin(8.39)}{9.81}$

T = 0.94 sec.

*For a Range of (60 m)*
➢ HORIZONTAL RANGE (R)

Range = $\frac{V^2\,sin(2\theta)}{g}$    Since $(sin^2\theta = 1 - cos2\theta)$

$60 = \frac{31.91^2\,sin(2\theta)}{9.81}$

$\theta = 17.65°$.

➢ MAXIMUMHEIGHT ($H_{max}$)

$H_{max} = \frac{V^2 sin^2\theta}{2g}$

$= \frac{31.91^2 sin^2(17.65)}{2 \times 9.81}$

$H_{max} = 9.36$ m.

➢ TIME OF FLIGHT (T)

T $= \frac{2\,V\,sin\theta}{g}$

$= \frac{2 \times 31.91\,sin(17.65)}{9.81}$

T = 1.97 sec.

# VIII. FABRICATION OF MACHINE



**Figure 8**

## IX. CONCLUSION

A soccer ball launching machine was developed successfully. To develop the machine different mechanical operation was done like drilling, welding, threading, grinding etc... Machine is applied for two games know as cricket and soccer. By using this machine two types of balls are thrown in the ground region with the help of motors and opposite rotating motion of wheels. Launching of the ball in horizontal and vertical planes and in trajectory motions using aerodynamic and mechanical principles. Launching machine was developed successfully to train the students at goal keeper area without the help of trainer.

## RESULTS

Fabrication of soccer ball launching machine was done in order to launch two different balls like cricket ball and soccer ball.

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