

Cost Effective and Long Range Football Launcher

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ABSTRACT: Cost Effective and Long Range Football Launcher is a proposed football training system to develop players' striker and goal keeping skills. Our goal is to include a football delivery system that will definitely help the player and domestic manufacturing thus, allowing for maximum training sessions. Ball launcher systems are already common and widely used in sports such as tennis, football, cricket and baseball. These devices have similar mechanisms but cost of are either expensive or not available in the domestic market. On the other hand, these systems are not easy to import. Our main design concerns will include direction capabilities of the ball delivery mechanism, manual less cost and auto loading of a ball, easy movement and lightweight with the body parts available in the local market. Football is a worldwide sport played by nearly every culture and background, an automatic training system will have great potential for both youth and professional levels of global soccer programs.

KEYWORDS: Cost effective, range, domestic market, DC motors, wheels, football.

I. INTRODUCTION

The team has worked on a prototype using concepts from commercially available launchers in the domestic market. Football is a worldwide sport played by nearly every culture and background; an automatic training system will have great potential for both youth and professional levels of global football programs. By building a football delivery system with the aiming, we hope to provide a cheaper device for all players of the sport. This system has extraordinary potential for future work as a good base for developments and researches can be implemented. Football launcher is a new form of football training that takes into account the already proven studies of skills' growth and football drills. The team will continuously improve and modernize the functionality and accuracy of the system. Many sports require the competency of collecting a ball. Sports such as football, handball, cricket, basketball, table tennis, lawn tennis, and squash require athletes to improve their receiving abilities. Interpreting the necessity of receiving drills, we saw the retirement to find a superior way to exercise this expertise more efficiently. The whole assembly is roughly at the height that a typical footballer or a striker and goal keeper would kick or catch the ball respectively. The motors are powered by a DC source and can be rotated in opposite directions. A controller allows variation of the speed of each wheel, allowing the machine to be slowed down for less experienced footballers. This paper presents this machine is capable to deliver with change of directions. Therefore, this machine is suitable for players of all abilities. The final advantage of having a ball machine is that players can use it anytime they like and anywhere whether it is local ground, professional stadium or backyard. They are easy to travel with and mean that players do not have to rely on anyone.

II. MECHANICALASPECS

CAD Model: For two degree of freedom platform, the design based on commercial simulator is made. First, the top platform consists of three legs. One has a universal joint permanent to ground and its spinning about its axis has been detached. This joint will restrict the launcher to the 2 degrees of freedom wanted. Furthermore, the launcher wheels to move on the ground. The insert joints show the input motors, which will be more torque low speed motors, and the spherical to spherical links consist of end rod joints. This configuration is shown in Figure(a).

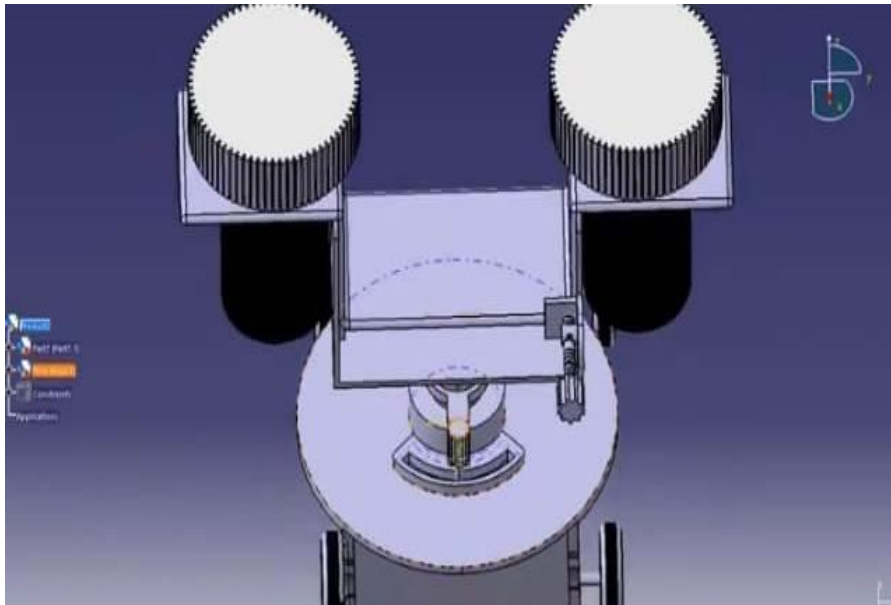


Figure (a) Solid Works Design

DOF Platform: This launcher is of extreme significance as it will supply the capacity for shot personalization in terms of swing, driven, strike and angled shots. The last platform of yaw will allow for slow revolving reverse in forward motions, the key to the platform will be the motors used to provide these launches, of which will be managed wirelessly.

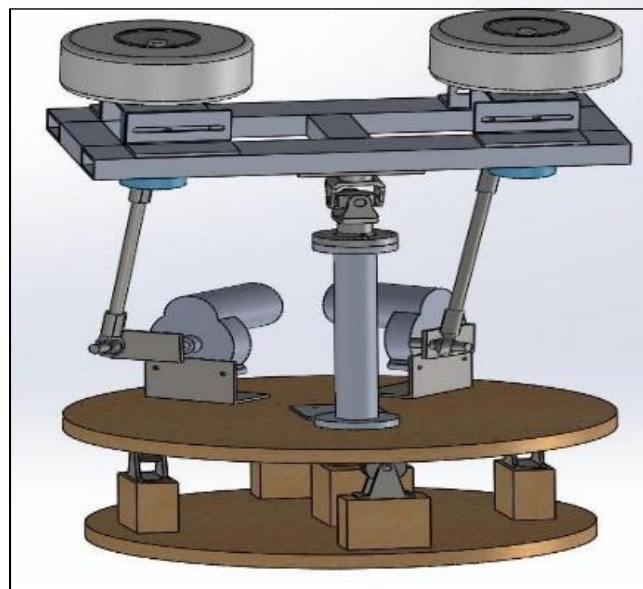


Figure (b) DOF Platform

III. ELECTRICAL ASPECTS

Electrical Circuit: The two flywheels provide the necessary punch to launch a ball as it is pushed through them; this function is of important need to the user's desire to provide different speeds of shots and curves. Curves are assured as one motor can be controlled to rotate faster than other one. The motors used were repurposed from an already existing ball machines and so not ideal for football purposes but still provide a necessary force. These motors are rated at 90

volts, 3 amps, and 4500 RPM which, through testing, was found to be sufficient for this model. In addition, two high torque motors were utilised to work the two degree of free of pitch and roll, of which could be finished to ensure a projected degree. These motors were rated 12 volts, 26 amp, with needed 2100 RPM and maximum 3000 RPM which was more than enough for the prototype’s purposes. For the yaw platform a motor with a maximum speed of 3000 RPM was used, of which can rotate. All of these motors were controlled individually. For the control of all motors in the machine, both must be able to be handled by the user. The motors to be used by the user will be the wheels, as the user will decide what kind of pass or shot, they want from launcher so they will tell the coach or player to adjust the speed of wheels. After a speed has been determined, the angle of the kick or strike must also be changed controlling the degree of freedom platform which will adjust the roll and pitch of the launcher as a complete. Each of these motions will have control of the angles of the shot as designated by the player or coach.

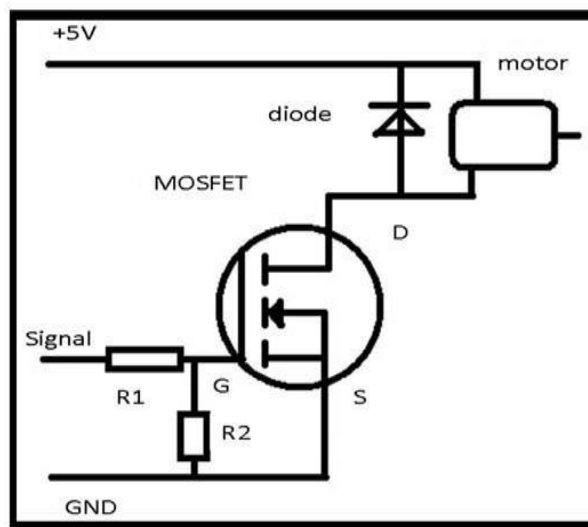


Figure (c) Electrical Circuit

IV. CALCULATIONS

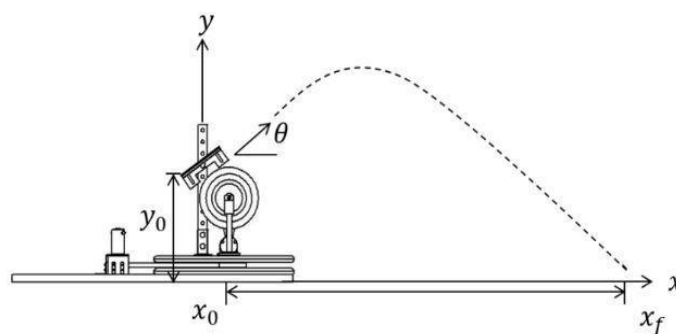


Figure (d) Trajectory

Trajectory of the ball: The main principle of the work is that each launch should be controlled by its trajectory, namely for all launch types and drill levels and for all aimed designations as well as for all locations of the launcher machine. The impact points are expressed in polar coordinates the origin of which is the actual position of the setup and the axis r ($\varphi=0$) is parallel with the longitudinal axis of the court. From former observation and analysis, the ball velocity range of football machine available in market is in between 20 km/h to 150 km/h. So, for this project, the ball speed launched from the launcher is assumed to be 100 km/h as the average speed. The position of the ball launcher is located 0.30 meters from the ground surface. So, the height progressed by the ball must be combined with this distance to get the whole height travelled by the ball. The throwing apparatus of this football launcher is designed with six different angles that can be modified. The angle options are 2.5° , 5.0° , 7.5° , 10.0° , 12.5° and 15° . The calculations are such below.



Elevation angle and thrown angle:

$$\text{Length } L = (V_0^2 \sin^2 \theta) / g$$

$$V_0 = 100 \text{ km/h and } g = 9.81 \text{ m/s}$$

Elevation Angle (Degree)	Thrown Length (m)
2.5	6.86
5.0	13.66
7.5	20.36
10.	26.91
12.5	33.25
15.0	39.33

Table (a)

From this estimation, it appears that the ball can proceed through ahead the minimum of the requirement starting from 5.0° elevation angle if the football launcher is placed right behind the baseline. The distance between the baseline and the net is about 12 meters. Although the thrown length at 15.0° elevation angle surpasses the total distance of the mini football ground, it does not influence this system as long as the football launcher can be regulated to be placed far back. This can make the ball launched falls right into the fronting side.

Elevation angle and thrown height:

$$\text{Height, } H = [(V_0^2 \sin^2 \theta) / 2g] + 0.33$$

Elevation Angle (Degree)	Thrown Height (m)
2.5	0.41
5.0	0.63
7.5	1.00
10.	1.52
12.5	2.17
15.0	2.96

Table (b)

From this estimation, it shows that the ball can pass through far off the earlier estimation starting from 10.0° elevation angle if the football launcher is stationed right in back of the baseline. Although the thrown height at 15.0° elevation angle quite excessive, it does not affect this setup because there is no height restriction at the football field. No problem if the ball is launched further as long as it falls right into the opposite side.

V. CONCLUSION

In this paper a Cost Effective and Long-Range Football Machine has been designed. Players can practice by adjusting the Football machine as per his/her requirement. The length of the ball being delivered can be varied by increasing or decreasing the angle of the ball by moving the universal joint. Freedom of adjusting the system gives practice opportunity to all types of players in Football such as mid fielder, striker, goal keeper etc. Necessary steps were taken to design and develop precise tilting mechanism to avoid major vibrations and variations in football launch. Football speed is variable ranging from 20m to 50m depending on the intended length.

REFERENCES

- [1] Crass, Scott. "Dynamics of a Soccer Ball". Rep. Mathematics, California State University: Long Beach. N.p., 1-18. Web.
- [2] "Sidekick." Sidekick. Keeper stop, 2016. Web. 17 Oct. 2016.
- [3] Gimbal Platform Pic "Super Gyroscope Gimbals (add-on Kit) - From Gyroscope.com." Gyroscope, n.d. Web. 17 Oct. 2016.
- [4] "Motion Base/Stewart Platform - Mark Roberts Motion Control." Mark Roberts Motion Control. Mr. Moco, 2016. Web. 17 Oct. 2016.
- [5] Herrera, Bryan; Savitz, David; and Raffaelli, Mikiah, "Automated precision passing system (2014). Mechanical Engineering Senior Theses. 28, 6-11-2014.
- [6] Jitendra Kumar and Sanchit Sharma, "Design and Experimental Analysis of Automatic Bowling Machine", MIT International Journal of Mechanical Engineering, Vol. 5, No. 2, August 2015, pp. 88-92.
- [7] Khairul Amzar, "Design and Fabrication of Thrower Mechanism for Tennis Ball Machine", University Technical Malaysia Melaka, June 2013.
- [8] Akshay Varhade and Hrushikesh Tiwari, "Cricket Bowling Machine", International Journal of Engineering Research & Technology (IJERT), ISSN: 2278-0181, Vol. 2 Issue 12, December 2013.
- [9] Jitendra Y. Sharnagat, Rahul Sonkuwar and Dr. Sanjay R. Ikhari, "Technical Aspect of Cricket Bowling Machine", International Journal for Research in Applied Science & Engineering Technology (IJRASET), ISSN: 2321-9653, Volume 6 Issue III, March 2018.
- [10] Izak Negron, Jose Perdomo and Richard Saco, "SkillCourt Autonomous Ball Launcher", 30th Florida Conference on Recent Advances in Robotics, Florida Atlantic University, Boca Raton, Florida May 11-12, 2017.