



The Design of Robot Combat Team for Wild Soccer Game

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ABSTRACT: The wild soccer is derived by the two different words i.e. wild and soccer. This is quiet like soccer but among bots. And meanwhile there is a fight too among these bots. Teams of players must work together in order to put the ball in the opposing goal while at the same time defending their own. In wild soccer, the robot mainly two works first soccer and second is combat to opposite team. In this paper we describe wild soccer robot with their weapons specification. Also describe design challenges and work output. It is experimentally found that soccer robot with weapons are successfully when they have high power wiper motor with high torque. The soccer match will win; defender robot will have high weight and high rpm wiper and double shaft weapon motor at least 15,000 rpm.

KEYWORDS: Soccer, Robot, Wiper motor, Torque, Match.

I. INTRODUCTION

Robotic wild soccer is a challenging research area, which involves multiple robots that collaborate in an adversarial environment to achieve specific objectives.

A. PROBLEM IDENTIFICATION

In soccer game object are ball, players and goal have different colors and thus seem to be easily distinguishable. In wild soccer game, robot attacks to opposite team players to destroy them [1] [2][3]. To solve this problem, each team has different color ribbons to identify each player or team. Or the robot can be controlled through human interface[4]. The algorithm or code is also designed to estimate the velocity from the encoder output and control its hardware through close loop embedded system.

II. HARDWARE IMPLEMENTATION

The design specification of the robot depends on requirement of wild soccer game. The selection of design also varies the estimate cost of robots, so it is essential to selection of components such as motors and solenoids should be meet all the specification of goal. In game, total 4 players are in each team with specific task [5] [6].

The complete project specifications limitations/ requirements are detailed as follows [7] [8] [9]:

1. The mass of a single robot will be no more than 10kg but one can be upto 25 Kg. This estimate was obtained by summing the individual masses of all components predicted necessary.
2. Dimension all robots should be in 55cm- 55 cm -65cm.
3. The robots will operate on a two or four wheel differential drive system in order to comply with the budget constraint.
4. The robots should be capable of achieving an acceleration of 1.0 ms^{-2} . From this value the torque required from the motors can be deduced.
5. The kicking device will, whilst the robot is stationary, propel the ball with a maximum speed of 1.0 ms^{-1} .

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 8, August 2015

A. SOCCER TEAM ORGANIZATION

Due to the complexity and scale of the project it is necessary that each player be responsible for selected work in soccer game. The complete design was divided into four main subsystems; Mechanical System, Vision System, Communications System and Control System. Wiper and double shaft motor are used in remote control (RC) hobby vehicles. The nature of RC racing, these servo motors are cheap, durable and have ample torque for their size but they losses in safety and high torque specification[9][10].

There were three types of robots we used.

1. Gunner
2. Striker
3. Goal Kipper

Gunner: We made gunner robots of 7 kg. The main aim of this robot to concentrate on goal. It usually pushes a ball and run fast throughout the field. For this purpose system of slider and a kicker mechanism is used. It was a four wheel drive bot. Wheels were of 7cm dia. Motor in wheels of 200 RPM & 5kg- cm torque.

Motor used in slider & kicker was of 100RPM & 5kg- cm torque. Mechanism of slider was designed by pulley system. Its dimension was 30cm*30cm*20cm[10]. The motor operated by L293D IC & microcontroller. It was wireless bot. The two batteries used were of 12V & 3amp. This robot totally controlled through wireless. As shown in fig 1.

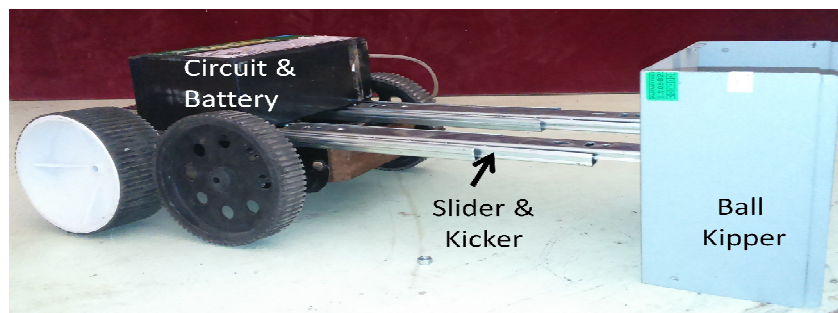


Fig. 1 The Gunner robot

Striker/ Fighter: The main work of strike is to guard the team member and secondary try to damage opposite team member. Specifications are: Dimensions- 15cm*15cm*10cm. Wheels were of 6cm diameter and weapon motors used were of 8000RPM to 11000 RPM. For provide the power on this robot wiper motor is used for wheels.

We used high torque double shaft motor as a weapon motor. The defender made by solid iron body. It was operated by microcontroller and relays. Two batteries used were of 12V & 3 amps. The Camera on the top used to identify objects and players. Its 360° camera to observe surrounding objects. Some of other Specifications were it is 4 wheel drive, Dimension is around - 30cm*28cm*20cm, resultant Weight is 16.8 kg, there are 4 Batteries-9V 3amp are used for operation; driver Wheels diameter is 6cm. used motors of 100RPM with 12kg torque[7][10]. Shown in figure 2.

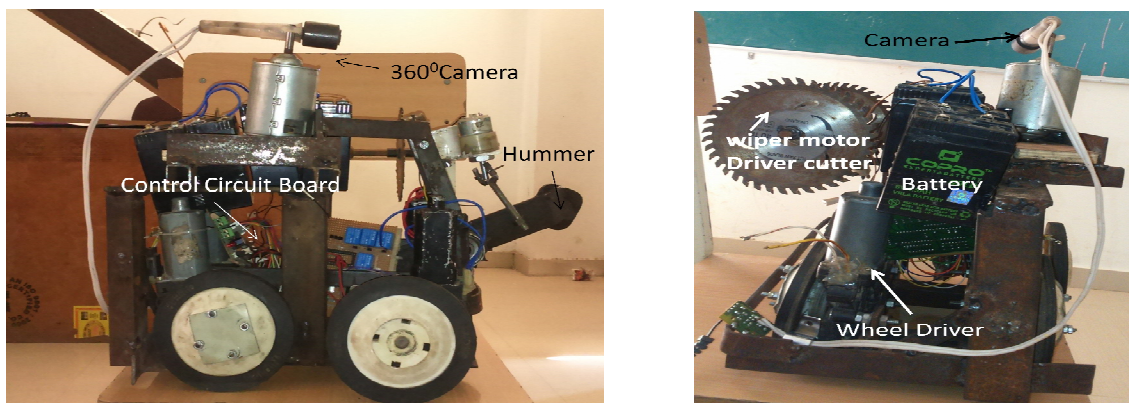


Fig. 2 The Striker/ Fighter Robot

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 8, August 2015

Goal kipper : The main aim of this robot is to protect the goal post. Its dimensions of this robot are 30cm* 27cm * 15cm. Wheels diameter was 4cm and 3 cm. It consists of 4 wheels. Stepper motors were used as wheels motor. The weight is around 4kg [10][11]. Shown in figure 3.

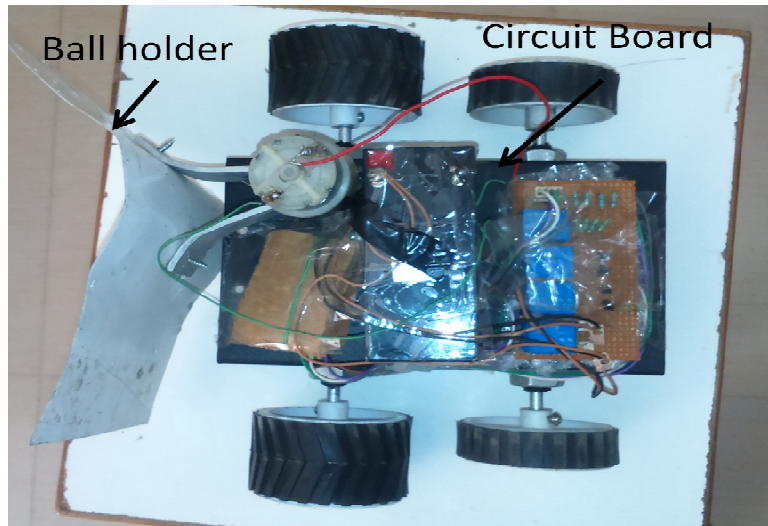


Fig. 3 Goal Kipper

III. KICKER MECHANISMS

The kicker mechanism is the component of the robot that propels the ball in a given direction. This component can have any number of varying designs, but most involve the use of a Slider to propel the ball in some way as shown in figure 4. This utilizes a slider that directly hits the ball propelling it forward. This design is cheap, and accurate. The problem is that there is not much room for error, since the pin from the slider may miss its target unless a groove or notch is assigned to ensure the ball is in place[12][13].

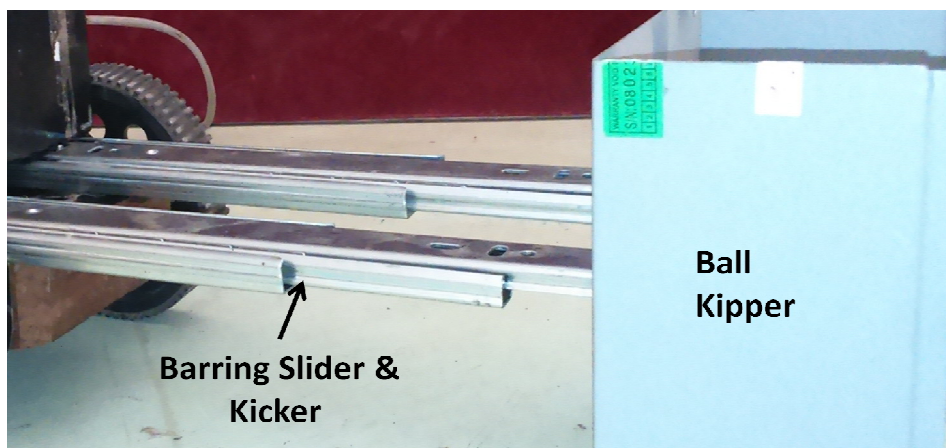


Fig. 4 The Kicker Mechanism

IV. COLOR BASED VISION SYSTEM

This design involves placing a unique configuration of coloured markers on the top of each robot identifying its location and orientation, shown in below table. The coloured markers are commonly the shape of squares, triangles, or

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

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Vol. 4, Issue 8, August 2015

circles for simplicity. A camera then takes images of the field, identifying the ball, the field, the goals, and the position and orientation of each robot, via their individual colour patterns. Below table show the color patterns for each object[14][15].

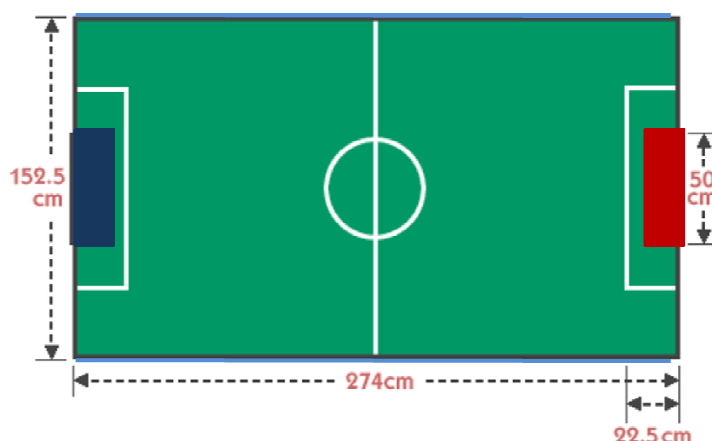
Table 1.: Color Coding system

Objects	Color
Ball	Yellow
Team A (Our)	Violate Ribbons
Team B (Opposite)	Red Ribbons
Goal Post A (Our)	Violate
Goal Post B (Opposite)	Red
Boundary	Blue

The SSL-Vision standard pattern is guaranteed to fit within a circle of radius 85mm that is linearly cut off on the front side of the robot to a distance of 55mm from the center. Teams must ensure that their robot tops fully enclose this area [16] [17].

V.EXPERIMENT AND THEIR RESULTS

In order to test the robots some experiments are performed. In a first experiment, the maximum force that the motor can deliver. The field has the size of a ping pong table. It is painted in green with blue walls and a number of white lines on it like as in defense areas, centre line, centre circle as shown in below figure 5. The goals are 50 cm wide, each goal and the area of the field inside the goal is painted in a special colour one violate and the other one red. An orange golf ball is used. The use of a wireless communication system which connects robots and a computer located outside the field.



The control of bots was good with the distance of 4.5meters. The belt transmission skids while driving in striker that is not a good approach, it is found that the spur gear transmission is the best option. In kicker, when the ball makes contact, it gets pushed away from the bar. A possible solution to overcome this problem is to suspend the kicker. A calculation is made to determine position of the kicker relative to the ground regarding the 20% rule. This rule states that no more than 20% of the ball can be covered by the robot. From tests, it is concluded that the kicker should be suspended in order to control the ball better. When the motor speed was reduced by applying a PWM-signal (pulse width modulation) the motor drivers started to heat up. It didn't take long before they were destroyed, to remove the over current protection i.e. the capacitor on the enable pin. The over current protection is too sensitive. This causes the



ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 8, August 2015

motor controller to switch off several times per second. Therefore, extra switching of the IGBT's inside is required with extra heating as a consequence.

V. CONCLUSION

The goal of this work is to develop the mechatronic design of a wild soccer-playing robot. Such a design includes the transmission system and a shooting system. The dimensions of the robot are limited by the rules of play. Implementing all the components in a small amount of space is a real challenge with their weapons. The construction and implementation of wild soccer robot team have been successfully completed.

The individual robots can be implemented successfully, but not to the extent that they can cooperate as a team so far. The vision system successfully enabled but the processing delay time is more. The overall system produced contains vision, communications, and motion control systems works all most correctly with some deficiencies and they will easily improve. After a comparison between the competing teams, the wiper motors provides good torque and play a main role in game for win.

The robot has to be able to hold the ball in front of it. The striker damaged the opposite team member with cutter easily then other weapon like hummer. The gunner usually too fast for this game and its slider move quickly but the aim is not meet from this.

ACKNOWLEDGEMENT

The authors would like to thank Mr. Vikram Singh & Mr. Vikram Singh Rathore for his support and guidance. A lot of thanks deserve the BIET Global Pvt. Ltd., Sikar for our projects.

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