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Design of an Intelligent Fighter Robot for Technex Robowar

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ABSTRACT: This paper is describing the design of war robot for IIT BHU robot competition Technex 2015. The design based on war application. The robot had 14Kg single tooth based roller with driver motor self of ambassador car. Our robot was tested on Warfield of IIT BHU live. In five matches our robot was secured second position in competition. The only one drawback of designed robot was lower speed and heat up of driver motor of roller. It was concluded that the robot shape and mechanism were found feasible for Warfield. Further work is proposed for the improvement of the current robot concept and for robot field experiments.

KEYWORDS: Robot, Technex, Driver motor, Warfield.

I. INTRODUCTION

"A robot is a specialized devices through variable programmed motions for the performance of a variety of tasks"[1]. Robowar is a game in which two or more bots fights together till death or fixed time[2]. The remote control and autonomous robot sumo contest is invented by Hiroshi Nozawa of Fujisoft ABC, Inc., in Japan. 1989 Inventor and entrepreneur Dean Kamen founds FIRST. This nonprofit organization, "For Inspiration and Recognition of Science and Technology," pairs up school-age children with local engineers to build robotic projects[3].

The Technex robowar competition plays on a knock-out basis and is a fight-to-the-death contest where one robot tries to destroy another in a 4-4 -minute time frame. If one of the robots becomes incapacitated for 30 continuous seconds, or is destroyed, that robot loses the match. If both robots are still fighting at the end of the 8-minute time frame, the winning robot is declared by how many points they scored. There are three official judges who award up to 10 points each for aggressiveness, damage, and strategy, for a maximum point till time ends.

The robot with the most points wins the match. Also Points awards once in a round, if the bot reaches opponent's starting point, which can be referred to as safe zone robot gets 10 points only once, for every pushing of opponent to danger zone scores 10marks. For major damage (weapon or motor) team gets 20 marks extra. If your robot is fortunate enough to survive the match, it has only 20 minutes to undergo any repairs before the next match. If the robot faces another fight soon afterward and cannot be repaired in the 20-minute time frame, it must forfeit the next match[4][5].

II.DESIGN RULES FOR ROBOT

Both wired and wireless remote controls are allowed in the event. The design rules of robot in Technex are; The robot dimensions should be 750mm x 750mm x 1000 mm (l x b x h) at any given point during the match and weight should not exceed 50 kg and up to 60 kg in wireless robot. DC Power allows only and IC engine in any form do not allow. The maximum DC power supply 36Volt is allowed in any point of bot. Weapon systems: robots can have any kind of cutters, flippers, saws, lifting devices, spinning hammers etc[4][6].

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Any kind of inflammable liquid / liquid projectiles, Smoke or dust based weapons, Flame-based weapons do not allow. For this work lab assistant verification certificate is required. The robot must use non-inflammable and non-corrosive fluids to power pneumatic and hydraulic devices. Maximum pressure in the tank containing pneumatic fluid should not exceed the limit of 10 bars and there should be a provision to check the pressure in the tank[7][8].

Battle field : The main Technex arena is called the Battlefield. Battlefield area is 10x10 feet, this "box" consists of a wooden floor, and lattice walls are 7ft high. There is one 2.5feet entry door where the robots enter as shown in figure 1.

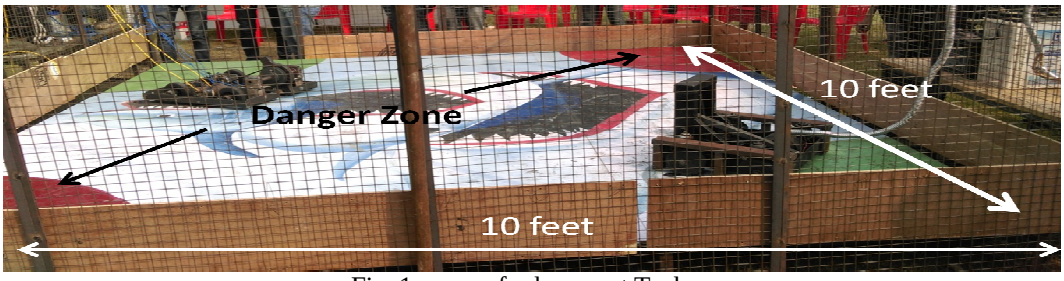

Fig. 1 arena of robowar at Technex

II. DESING FLOW

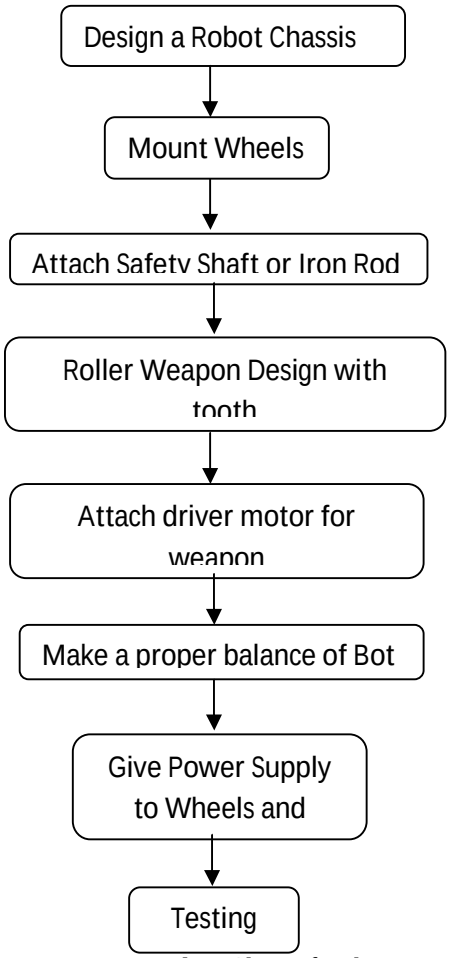

Fig. 2 Design Flow Chart of Robot

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The Figure 2 shows the steps of manufacturing of robot for war application. It starts from manufacturing of chassis of robot then after mount suitable wheels on it. Also a safety road will attach surround[9]. Next step is to manufacture Roller weapon with single tooth. For drive a weapon a powerful driver motor will required, so car starter is batter choice. The balance was another point to consider because in running condition it will affect the working of robot too much[10].

IV.HARDWARE IMPLEMENTATION

The following subsystems are part of our robot named shaktiman. Each of these subsystems relates to the others and affects the overall design of the bot: Robot frame, Drive motors, Power transmission, Batteries, Wheels, Electronics, and Weapons etc.

Chassis: This is where to use as much imagination as may possess. We had built robots that, aside from the electronics, were constructed entirely out of materials acquired as shown in figure 4. The dimension of chassis robot is 35cm and 50 cm. It also supports the safety requirements, for this purpose a solid iron angle (L and U-Shape) is welded at both ended.

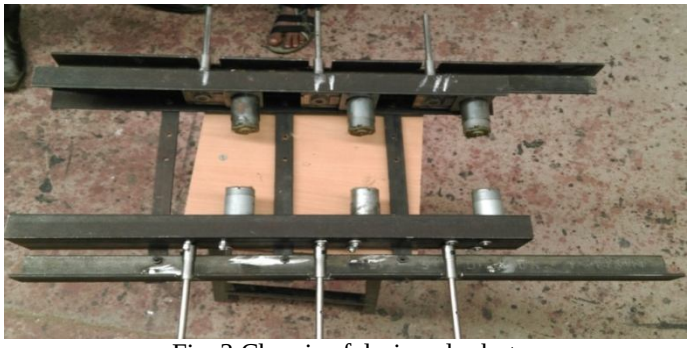

Fig. 3 Chassis of designed robot

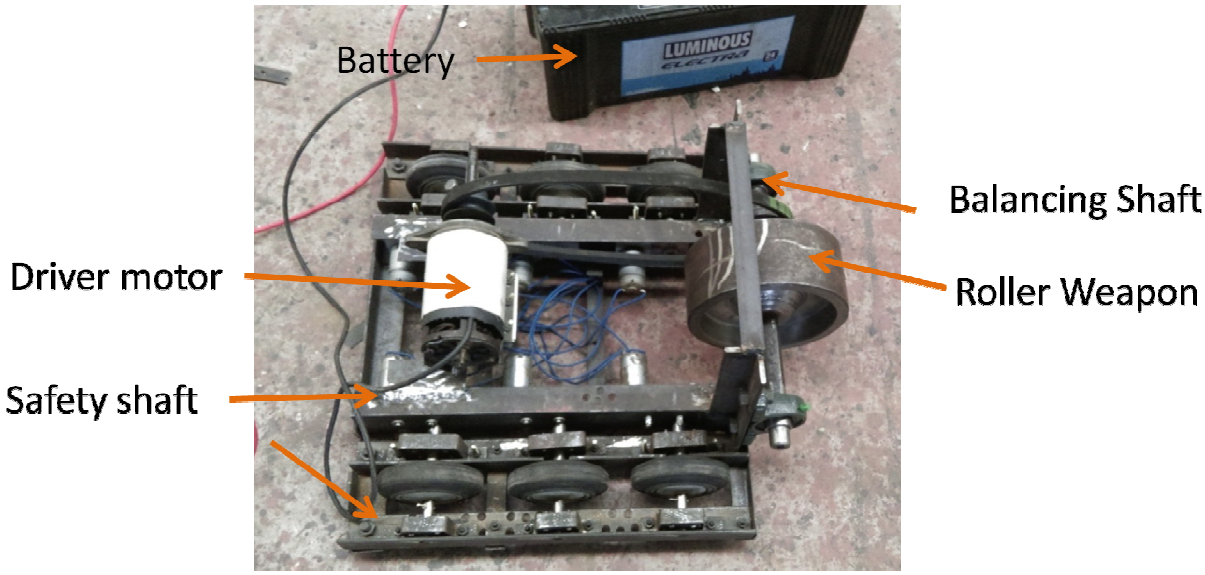

Fig. 4 Specification of robot

Motors: The total weight should be 50 kg maximum so for robot movement at least six motors are required. The motors by themselves are not particularly useful; they spin too fast and with little real power. There are two basic motor types out there to be controlled; Brushed & Brushless. For the cheap 18.36451 lb bot, get a brushed gearbox motor. The motor rpm varies according to applied DC voltage, 100 rpm at 12V and 150 rpm at 24V.

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Weapon: As per guidelines of Technex, were attached a 21 kg solid roller in the front of robot. The roller has a single jaw for attack. It increases the speed but also makes instable in roller movement, so the size of jaw is optimum to overcome this problem. For drive this big heavy roller a big amount of power is required. For this we were used self of ambassador car. The power of self is and its rotation is around 5 seconds. The weapon specification is shown in below figure 5 and real picture shown in figure 6.
a: inner shaft hole diameter =1Inch
b: Outer weapon diameter = 8Inch
c: Weapon width =3.5 Inch

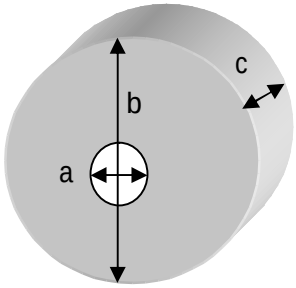

Fig. 5 Roller Specification

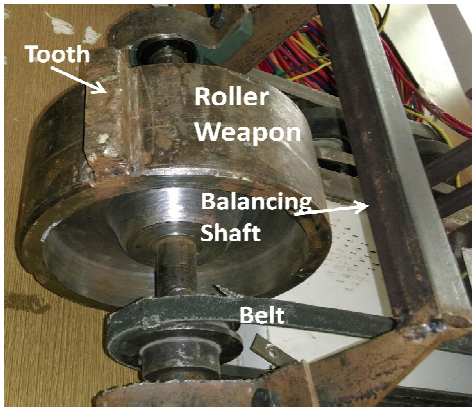

Fig. 6 Manufactured Roller

Connection wire specification: For connection 16mm wire for weapon, 8 mm for driver motor and 20mm for power supply connected to bot. Two 12 volt with 150 Amp DC s batteries were required for our robot. So we used luminous battery to give power.
Weapon Driver: For weapon drive a high speed with high starting torque motor was required so self of ambassador car was used for this purpose.


Fig. 7 Self of Ambassador Car as Driver Motor

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V. RESULT

The Technex robowar were held during 28 Feb to 1 march 2015. Our first match our robot won with 50marks in 3 minutes and no damage to our robot. Next match were held 1 march in second round damages were roller weapon shaft bearing damage won with 20 points. The third round was held on same day and we won with 20 points and damages were chassis and motor nut bolt. The semifinal round held on 1 march; wheel motor damage and bend on weapon shaft. But match won with 10 points. During that match major damage to robot, after that match robot was repaired before final match.

The final match was held on same day with SRM Faridabad team, Lucknow. Final round fight played on a dead basis. The opponent robot also had small roller weapon but drive motor was heavy to drive. The weapon motor failed during fight due to heat-up and heavy load, that was major damage due to this opponent team won the match with minor points (10 points). Also took repairing time 15 minute around due to side safety shaft was damaged.

VI.CONCLUSION

The robot was manufactured for war game application. The manufactured design was totally follow the guidelines of Technex 2015, IIT BHU. The match rounds were held on 27th Feb. to 1st March 2015. It was observed that the design was perfect to defense purpose. The U shape of designed back shaft provided better resist for opponent attack. The weight of roller was 14Kg so it very difficult to balance, so driver motor and additional metal attached to opposite side. The self of ambassador car was used for as motor driver but it's failed in last final round due to heat up, so more batter heavy motor was required. For future work and events we will increase the aggressiveness of robot with increase the number of weapons. For better efficiency of weapon should use high starting torque motor like automatic wheelchair motor (at least for 60Kg) and hard metal like ENB, steel etc. Our robot secured second prize with cash on this event, also got best design award.

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