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Designing a Slot Car –Hammerhead Car

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Introduction

The aim of the project was to create the fastest slot car, designing the chassis all the way to the bodywork, which would be raced against other teams on an 18m track. The design was restricted to have a minimum profile of 220mm by 120mm and an area of 100mm by 90mm to be reserved for electronics. The restrictions allowed the group to focus on the theme of a shark/formula one car and this was chosen because of the effective aerodynamic body shape for speed. All five members of the team were able to participate in creating an aspect of each component. At the end of the designing process, the car is to be raced to determine the fastest time and gear ratio to reach the end of the track.

Design/Experimental Approach

The desired gear ratio was chosen through using the calculations shown in Table 1.0 below. In the end the chosen ratio was 10/22 and it was calculated to be the slowest however, it allowed the car to accelerate faster gradually along the track and prevent wheel spin. This was also complemented through using a wider wheel at the front as it increased the amount of friction at the start.

Chassis: The template of the chassis was designed on paper and cut out to form a template that would be placed on the plywood. The plywood was then cut out using a scroll saw and later finished using the sanding bobbin and hand files. The track pickup already had 3 possible areas where it could be placed on the plywood, offering flexibility with the overall design of the electronics. In Figure 1.1, this is displayed, where later holes were drilled for bearings and this was sanded for a tight fit. Extra weights of 200g were added to increase downforce to assist traction and stability in the vehicle.

Body: Once the chassis had been cut, we created a 3D model of the body to gage an idea about the 3D dimensions of the car. High density polystyrene and a hot wire were used to accurately cut the shape and this was split into two separate parts to make it easier to vacuum form the shell later on. Modroc was applied to the foam to create a layer that would prevent the foam from being damaged during the vacuum forming process. A prototype was initially made using the vacuum formed material, high impact polystyrene, to make sure that the body fitted correctly. Once the second result was successful, the foam was excavated to reveal the final shell. Tabs were added and cut out to attach the shell to the chassis and these were later bent using the line bender.

Aesthetics: To create the final look, insulating tape was used for eyes, mouth, '1' and racing stripes to resemble a racing car over the body. Spikes were later attached to the wheels to create fear to the opponent and this was made by spray painting the ends of six pencils and using a hot glue gun. The fins were created using leftover high impact polystyrene, cut using a hegner saw and attached using tabs.

Table 1.0 Calculating the Gear Ratio

T1	T2	T2/T1	S1 x T1	S2	Distance (cm/min)	Time (m/s)
10	12	1.2	110000	91666	172332	0.6
10	15	1.5	110000	7333.3	137866	0.78
10	22	2.2	110000	5000	94000	1.15
12	15	1.25	132000	8800	165440	0.65
12	22	1.83	132000	6000	112800	0.96
15	22	1.46	165000	7500	141000	0.77

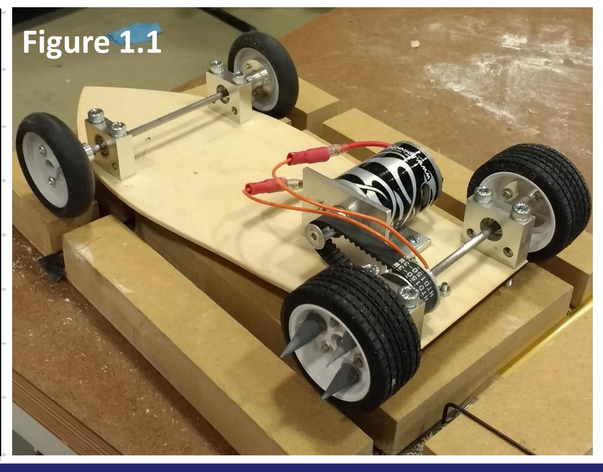

Table 1.0 : The calculations for picking the gear ratio

Figure 1.1 : exposing the electronics, bearings, motor, belt and gear cogs

Figure 1.2 : the car completed

Results and Discussion

The slot car averaged at a speed of 5.227s once tested on the 18m track with the fastest timing being 4.430s (as illustrated in Table 2.0). To begin the race, the cars are positioned on the track, two buttons are pressed by a member of the team and the cars timing is measured using a sensor triggered timer. This measures the exact time the car interrupts the light on the finishing line. The car was able to perform well during the test, with partial damage occurring to the paintwork of the spiked wheels. However, the timing could have been improved if the shell of the body didn't rest on the wheels as much as this caused friction and could then be a health and safety hazard. Table 2.1 contains a list of the health and safety risks involved with using the equipment for this product.

Table 2.0

Test	Track Times
1	5.448
2	5.461
3	5.568
4	4.43

Table 2.1 Risk Analysis Table

Risk	Action taken to prevent risk
Sander (Bobbin)	Keep fingers away from bobbin
Hair in machine	Tie hair back
Swarf in eyes	Wear eye protection
Sward on clothes	Wear appropriate lab coat

Conclusions and Future Plans

Overall, the project was successful in creating the fastest time on the track, winning by an average time of 0.15s. The team were able to work well in the time schedule to design a slot car to race on the 18m track. Things to change for next time include securely attaching the body of the car to the chassis, with the appropriate fittings, to prevent friction on the wheels. Another idea would be to 3D print the shell to give a smoother finish and to add extra weight where needed.

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