ME 476C – Smart Helmet

Final Prototypes Summary

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Summaries of Teams Prototypes

Bee Team

The Bio Inspired Energy Efficiency Team's prototype was a 3D model of the improvements made on the current HVAC system for the SBS building at NAU. Their device is the ventilation portion of the HVAC system and will be replacing the roof top portion of the existing design. Their design will use a bio inspired size changing material, nitinol to open and close the vents. Solar panels will be placed on the design to also collect renewable energy from the sun. Their prototype consisted of a stress analysis for the structure of their device. After doing the stress analysis, more bracing was implemented into the design to account for the stresses from the estimated snow load

HoneyBear Team

The main idea of this project is to create a rotational piece of bearing and plot the result as a torque plot. This team brought a rotational bearing to the presentation on Monday. They explained the design of the rotational bearing in details using a 3D printed model along with balloons acting as their hydraulic system. One of the company requirement of Honeywell is safety. In more details, the team discussed the performance of the rotational bearing, and how they improved the safety in the rotational bearing.

SAE Aero Micro Team

The Aero's prototype was a simulation using RealFlight based on the parts and weight of their design. The simulation is able to use the team's remote controller to control the plane in RealFlight and by doing so, the team will have the experience of flying the real plane. The simulation can only so much for the team, these are only assumptions until the team is able to put their plane to the real test.

Rube Goldberg Team

The Rube team presented about nine prototype designs that will be incorporated into their final product. These designs are going to be the team's main steps while implementing some of the previous team's steps into their own. These nine designs are meant to be self-setting, so the use of human interaction will be limited, and the team also aims to create a cartoon theme with these steps.

Summary of Final Prototype

The final prototype of Smart Helmet project can be found in figure 1 and 2. From ME 476C, the team focused on a football hamlet. The team's goal is to create the smart helmet for all kind of sports. From now until testing the hamlet which will be in April 2019. The team will use the helmet in figures 1 and 2. The reason of choosing the bicycle hamlet instead football hamlet as example is having more ease and convenience about adding the material which are laser sensors, Arduino, Viscoelastic, battery, data memory and others. Viscoelastic material can find in figure 2 and in will be explained more in the next section.

Figure 1: Photo of the Testing Helmet


Figure 2: Viscoelastic Material inside helmet

D3O is an impressive material which can be used in the helmet to make it efficient in its shock absorbing capabilities. Moreover, the impressive design of the D3O at the molecular level makes it an extra ordinary invention as it molecules contract making it stronger to resist impulsive forces and as the molecules of D3O compress in a designed manner, the resultant of impulsive force is reduced as the shock is absorbed by the material. However, this martial will help the player to be safe and reduce the amount of concussions. How D3O work in the helmet, the molecules of the material are locked together and absorb the energy imparted by the external impulsive force while it also makes the material stronger as the molecules are locked and the stress bearing capacity of the material is enhanced. The

following image depicts the working of D3O material and why it is used in the life saving products in the helmets.

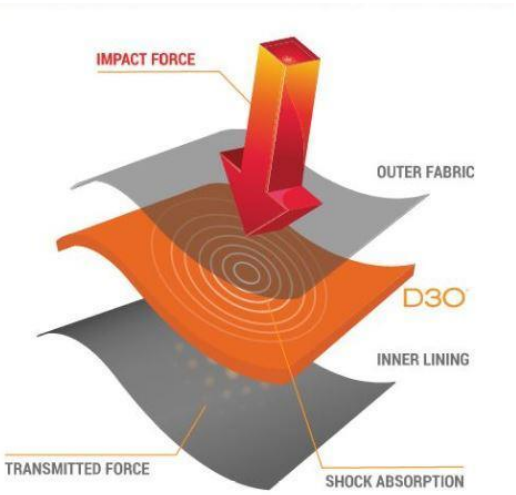

Figure 3: Details of D30 Material

as a result of using this material in the helmets, Football, the shock absorbing capabilities of the products can be increased to an optimum level keeping the cost effectiveness of the material under consideration. As this material is cost effective as well as durable, it can also be used in daily life products which not only increases the durability of the products in which D3O material is used, but also results in increasing the shock absorbing capability of the products in which it is utilized. However, the team is trying to make the helmet has high safety than others by using D3O martial and this will be the future goal.

Table 1: Bill of Materials

Parts #	Component Description	Quantity	Total Cost	Ref.
1	Football helmet	1	$107.95	[1]
2	MR fluid	1	$800	[8]
3	Battery	1	$3.91	[2]
4	Viscoelastic	1	$30	[5]
5	Laser sensor	2	$28.54	[6]
6	Arduino	1	$60	[3]
7	Data memory	1	$19.99	[4]
8	RTCSD-01	1	$17.95	[7]
	Total		1,068.34	

Bill of Materials

The team has conducted the economic analysis that can be found in table 1. The bill of materials displays the part numbers, component description, how many pieces needed to have for each component, what is the cost with the reference that the team used to know how much each part cost. The material that would go into the smart helmet are battery, MR fluid, Viscoelastic, laser sensor, Arduino, data memory, and RTCSD-01. By having the Economic analysis, the team found the total cost of smart helmet design that would be $1068.34.

References

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