Component Analysis

Year: 2018   **Semester:** Fall   **Team:** 07   **Project:**Handi_glove
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Assignment Evaluation:

Item	Score (0-5)	Weight	Points	Notes
Assignment-Specific Items				
Analysis of Component 1	4.5	x2	9	
Analysis of Component 2	5	x2	10	
Analysis of Component 3	5	x2	10	
Bill of Materials	5	x6	30	
Writing-Specific Items				
Spelling and Grammar	5	x2	10	
Formatting and Citations	5	x1	5	
Figures and Graphs	5	x2	10	
Technical Writing Style	4.5	x3	13.5	
Total Score			97.5	

5: Excellent   4: Good   3: Acceptable   2: Poor   1: Very Poor   0: Not attempted

General Comments:

Good work.

It seems that you have a clear understanding which components work the best for your project.

What about the robotic hand? Are going to order it or build it yourselves?

1.0 Component Analysis:

1.1 Analysis of Component 1:

H-Bridge(for linear actuators)

Product	DRV8816	L6206	DRV8871
Description	DMOS Dual 1/2-H-Bridge Motor Drivers[1]	DMOS dual full bridge driver[2]	Brushed DC Motor Driver With Internal Current Sense[3]
Pin Function			
Max Current	2.8A	2.8A(5.6A Peak)	3.5A
Number of Motors	1	2	1
Operating Voltage	8-38V	8-52V	6.5-45V
Overcurrent Protection	Yes	Yes	Yes
Overtemperature P.	Yes	Yes	No
Price	$1.892	$5.78	$2.73
Input Logic High	2-5.5V	2-7V	1.5-5.5V
Package Dimension	4.40 mm × 5.00 mm	11mm × 16mm	5mm × 6.2mm
			CHOSEN

The H-Bridge is used for manipulating the direct current in order to extend or retract linear actuators. The steady current usage of an unloaded linear actuator is 0.5A under 12V DC and the starting peak current can reach up to 1A. In this project, linear actuators are only used to push syringes to inflate airbags places at the fingertips of the glove; therefore, the workload will not significantly influence the current consumption.

Three candidate components are found in the market: DRV8816, L6206, and DRV8871. All three H-Bridge chips meet the current and voltage requirements of our project.

One of the most important factors we are considering is the ease of use. Of all 3 H-bridges, DRV8871 has the fewest number of pins and requires the least amount of manual PCB routing and peripheral capacitors and resistors. Although the DRV8816 and the L6206 have overtemperature protection features and the DRV8871 does not, overtemperature protection features are not heavily weighted in terms of our decision making. We do not plan to consume
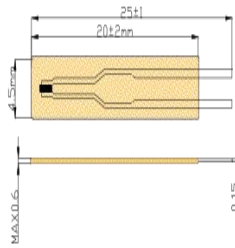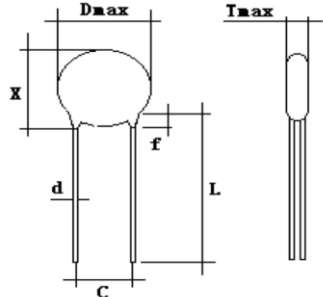
power over the DRV8871 maximum power setting of 3.5A and 45V; thus, the feature of overtemperature protection should be relatively unimportant in our project.

1.1 Analysis of Component 2:
Temperature sensors

      The temperature sensors and Peltier modules work with each other to realize the data communication between the robotic hand and the user glove. The temperature data is first fetched by the temperature sensor circuit and then being sent into the temperature processor block, where the temperature analog signal is converted into a digital signal and is further processed. The result is afterwards sent to the temperature controller to complete the temperature feedback system.
      In order to maintain the real-time temperature transmission, we will add extra temperature sensors in the glove to form the system loop. Using the microcontroller of the glove, the real-time temperature can continuously transmit from the robotic hand to the user glove. There are two candidate component temperature sensors.

Product	TTF-103 [4]	NTC2.5D-25 [5]
Dimensions (mm) **(20pts)**		 | Dmax	Lmax	C+/-1	Tmax	d+/-0.5 | | 29 | 30 | 10 | 8 | 1.0 |
Temperature range **(15pts)**	-30 to 125 °C 15pts	-40~170°C 15pts
Thermal time constant **(30pts)**	<3 s (in air) 30pts	<130 s (in air) 5pts
Maximum power rating **(10pts)**	3.0 mW (9pts)	5.0 mW (10pts)
Dissipation factor (10pts)	Approx. 0.7 mW/°C (in air) (9pts)	<30mW/°C (in air) (10pts)

Price (15pts)	1$ (15pts)	4$(12pts)
total points	98pts	72 pts
	CHOSEN	

As shown in the above table, there are 6 different factors that are taken into consideration in our decision making. The first factor is the size of the temperature sensors. A relatively small sensor should be selected due to the robotic hand size limitation and user glove size restriction. According to the component dimensions and the graphs shown above, both sensors fit the desired design requirements. The second factor is the range of temperature that can be measured. The temperature safety threshold for human skin is -30 degrees Celcius to 71 degrees Celsius. The suitable temperature range for this project is -20 ~ 60 degrees Celsius and both of the sensors properly lie in the temperature range. The most important factor is the thermal time constant for the temperature sensor. TTF-103 is preferred over the other one because it reacts more swiftly in terms of the thermal time constant. Moreover, the price of TTF-103 is much cheaper than the NTC2.5D-25. Although the maximum power rating and the dissipation factor for temperature sensor TTF-103 are not as good as these factors of NTC2.5D-25, these factors do not weigh as much as the other factors mentioned earlier. In conclusion, we have determined that TTF-103 [4] will be used in our project.

1.1 Analysis of Component 3:
Pressure sensors

Product	RFP-602 [6]	FlexiForce® Standard Force & Load Sensors Model # A401 [7]	FlexiForce™ Standard Model A201 [8]
Sensitive Area Diameter	10 mm	25.4 mm	9.53 mm
Measuring Range	10-500g	0 - 25 lb	0 - 100 lb
Size	10 x 49mm	31.8 x 56.8mm	14 x 191 mm
Price	$8.00	$24.95	$19.95
	CHOSEN		

We plan to utilize pressure sensors on the fingertips of the robotic hand. They will serve to detect any obstacles encountered and their signal will be used to translate into the sense of "touch" felt by the user wearing the glove. Since the pressure sensors will be stuck onto the fingertips, one of the biggest limitations is the size of the sensor. In the following 3 options, the RFP-602 [6] and FlexiForce™ Standard Model A201 [8] both have a much smaller size and sensitive area than those of the FlexiForce® Standard Force & Load Sensors Model # A401 [7]; thus, eliminating FlexiForce® Standard Force & Load Sensors Model # A401 [7] from our choice of selections. In comparing the RFP-602 [6] and the FlexiForce™ Standard Model A201 [8], the significant differences lie in the measuring range and the price. We expect that our frequently encountered range of force will lie around 300g. We got this number from holding a can of coke (340g) [9] on our fingertip. It is difficult to hold this much weight for a long time, from our personal past experiences, this felt like a greater force than what our fingers will typically come across. The FlexiForce™ Standard Model A201 [8] has a measuring range from 0-25 lbs (0-11339.8g), which is far greater than the 300g we are expecting to encounter. In addition, the price of the FlexiForce™ Standard Model A201 [8] is $19.95, which is more than 2 times the that of RFP-602 [6]. By comparing various aspects of different pressure sensors, we have determined that the most suitable pressure sensor for our project is the RFP-602 [6].

2.0 Sources Cited:

[1] Texas Instruments, " DMOS Dual 1/2-H-Bridge Motor Drivers," DRV8816 datasheet, Sept. 2013 [Revised Feb. 2016].

[2] STMicroelectronics, "DMOS dual full bridge driver," L6206 datasheet, n.d. [Revised Mar. 2017].

[3] Texas Instruments, "3.6-A Brushed DC Motor Driver With Internal Current Sense (PWM Control)," DRV8871 datasheet, Aug. 2015 [Revised Jul. 2016].

[4] Unknown, "Thermistor," TTF-103 datasheet, n.d..

[5] Allconne International Co., Ltd., "Power NTC Thermistors," NTC 5D-25 datasheet, n.d..

[6] Centenary, "Ultra-thin High Sensitivity Nano Pressure Sensor," RFP-602 datasheet, n.d..

[7] Tekscan, Inc., "FlexiForce®," Standard Force & Load Sensors Model # A401, n.d..

[8] Tekscan, Inc., "FlexiForce®," Standard Model A201, n.d..

[9] Coca-Cola Products, "Original 12fl oz.," *coca-colaproductfacts.com/*, n.d.. [Online]. Available: https://www.coca-colaproductfacts.com/en/products/coca-cola/original/12-oz/. [Accessed Sept. 06, 2018].