Question 1 : Have your project milestones or plans changed? Do you have any concerns?

The original plan was to build and program an obstacle avoiding robot car that can accomplish 4 tasks:

1) move at a reasonable speed
2) accurately detect and properly stop in front of obstacles (wall)
3) decide which direction to turn to avoid the obstacle
4) fine-tune the steering action to ensure the proper facing direction

However, since one team member dropped the class, now the project scope is reduced to prioritize task 1 and 2, with task 3 and 4 being optional.

Since the project has turned into an individual project, the main concerns are that no one would be able to correct my mistakes in advance, and that successful operation of the robot now entirely depends on my ability to solve problems and correct my own mistakes.

Question 2: What progress have you made toward your final project since last report? What are your next steps? How are you partitioning the work among team members?

Since last report, mechanical and electrical components have been selected.

The next steps involve:

- read and calibrate the ultrasonic sensor HC-SR04, while waiting for other parts to be arrived
- finalize wiring/packaging and start assembling the vehicle
- laser-cut/3d-print/order additional components if needed
- prove that sensors are providing proper feedback
- prove that the system can take proper actions based on readings from the sensor

Question 3: How did you model your system to determine your necessary actuator specs? What specs have you considered? (e.g. motor size, torque requirements, loading conditions, power requirements).

The system requires one servo motor to change orientation of the ultrasonic sensor, and two identical DC motors to power the wheels.

Since the ultrasonic sensor can be easily turned with minimal torque, main considerations for selecting the servo motor are lightweight, compact, and, most importantly, can be powered directly by MSP 432 (3.3V/5V).

The DC motors been used to drive the wheels are selected mainly for that they come together with rubber wheels and have been proven to be functional in similar projects.

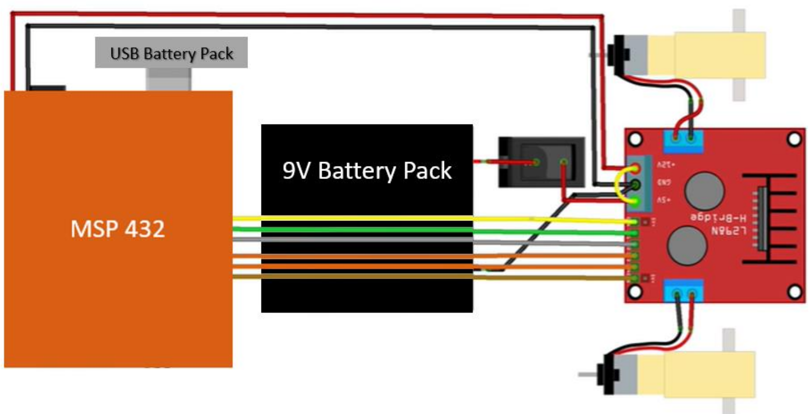
Question 4: What factor of safety did you choose for the actuator?

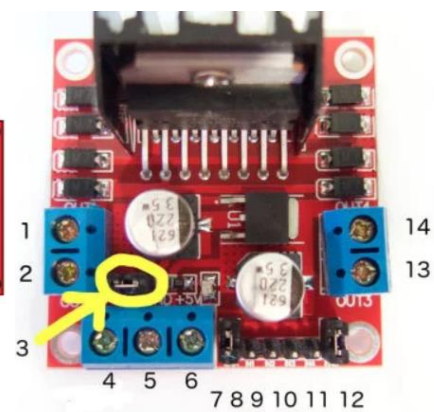
Since DC motors been used to drive the wheels have been proven to be functional in similar projects, and maximum output torque does not play an important role in selection of the servo, factor of safety calculation was not performed for the actuators.

On the other hand, the major safety consideration is that since the motor driver requires a higher operating voltage than the maximum operating voltage of MSP432 (3.3V), they are powered independently. In addition, since the ultrasonic sensor operates at 5V, while MSP432 is a 3V board, a level shifter will be used.

<u>Question 5: Will you be purchasing a motor driver board to go with your motor? Do you know how to connect to it?</u>

The servo motor used to turn the ultrasonic sensor does not require a motor driver board, but a dual H bridge motor driver L298N is selected to drive the two DC motors used to power the wheels. It allows for voltages from 5V to 35V and can drive the motor forward or backward. It will be connected as follows:




1. Motor A +
2. Motor A -
3. 12V jumper
4. Motor supply voltage
5. Ground
6. 5V out if 12V jumper is in place
7. Motor A enable jumper, jump if using a stepper or connect PWM for DC motor speed control
8. IN1 (Motor A direction control)
9. IN2 (Motor A direction control)
10. IN3 (Motor B direction control)
11. IN4 (Motor B direction control)
12. Motor B enable jumper, jump if using a stepper or connect PWM for DC motor speed control
13. Motor B +
14. Motor B -

| Actuator Specifications: List the electrical actuators you plan to use in your device (5 points) | | | | | |
|---|---|---|---|---|---|
| Component Name(Cost) | Description | Performance Requirements | Performance Specifications | Power Source | Control Method |
| SG90 Micro Servo ($5.95) | 4.8V nominal (3V to 6V DC) servo that can rotate 180 degrees | Speed : 1 sec/60 degree<br>Torque : 0.25 kg-cm | Speed : 0.1 sec/60 degree<br>Torque : 2.5 kg-cm | MSP432 (which will be powered by a USB battery pack) | PWM control using MSP432 |
| DC TT Motor ($3.50 each) | 3V-6V DC TT Motor for Smart Robot Car | Speed: 30 RPM<br>Torque: 0.074 Nm [1] | Speed: N/A<br>Torque: N/A | 9V battery pack & motor driver L298N | PWM control using motor driver L298N |

[1] $T = F*d = 0.5*friction*r_{wheel} = \mu*N*r_{wheel} = 0.6*0.5kg*9.81\ (m/s^2)*0.025m = 0.074Nm$