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

Since now we have two team members again, we resume the four major milestones of our project:

- Sourcing and building basic hardware for the system
- Validating successful operation of the electrical system, and proving that sensors are providing proper feedback
- Programming an operating system that can move forward & backward, execute basic steering maneuvers, and stop properly in front of obstacles
- Fine-tuning the steering action, ensuring proper facing direction after steering
- Finalize CAD model and prepare simulation results for sensors, actuators and the control system

As of now, the first milestone has been completed and we are working toward the second milestone. Some of the concerns are:

- How to model the vehicle driveline & control system using Simulink?
- With the physical prototype being built, can we have a less detailed CAD model?

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?

As of now, we have acquired most of the sensors and mechanical parts we need and started assembling the system.

In the following 2 weeks, we are going to test and calibrate the sensor's signal acquisition capability, test DC and servo motor performance, and finish coding the control algorithms.

Since both of our members are still living on campus, we are working on the project together while meeting up.

Question 3: Justify your selection of sensors. Were there alternative sensors you could have chosen, and If so, why did you select the one(s) you did? What were the factors you considered? (e.g. range, resolution, voltage requirements)

One ultrasonic sensor (HC-SR04) is selected for the system to measure its distance away from the wall.

HC-SR04 is selected for its balance between range, detection angle, and price. It is suitable for medium to long range detection with its 40kHz 8 cycle burst waves and has a rather small dead zone. Its low price helps to keep the budget low.

Sensor Specifications					
Component Name	Cost (US$)	Range	Angle	Resolution	Voltage Requirements
HC-SR04 ultrasonic sensor	2.99	2cm – 4 m	15 deg	40kHz 8 Cycle burst	5V DC
Parallax's PING))) Ultrasonic Sensor	29.99	2 cm - 3 m	N/A	40 kHz for 200 µs	5V DC
Obstacle avoidance IR sensor	4.86 but only has digital output	2 - 30 cm	35 deg	N/A	DC 3V-5V
IR proximity sensor - Sharp GP2Y0A21YK	13.95	10 - 80 cm	Smaller range than HC-SR04	3.1V at 10cm to 0.4V at 80cm	DC 0V-7V

Question 4: Some sensors (e.g. analog resistors, FSRs) require very stable power sources, while digital sensors (e.g. encoders, I2C) sensors are less susceptible to noise. What sources of error/noise do you expect? How do you plan to condition your signals to accommodate that?

Sources of error I would expect includes:

- External ultrasonic sources other than wall reflection might introduce noise into the sensor feedback, which might be environment specific and requires more trial-and-error to be determined. Once the effective signal pattern of wall reflection is found, we can use filters and amplifiers to condition the effective signals and make them dominant.
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- Directionality of ultrasonic sensors might also interfere with precise signal acquisition. In order to compensate for this, we would perform a mechanical sweep over the frontal area using servo rotation to ensure there's no obstacle on the vehicle's course.

Question 5: Describe how you plan to power your sensors and how you plan to manage any variations in voltages that are needed by different parts of your system (include a wire diagram). If you have a battery powered system, provide a back-of-the-envelope estimate of your battery life (refer to 'Supplemental Notes – Power Sources: Batteries' on Canvas).

MSP 432 will be powered by a 5V portable power bank. Both the servo motor and the ultrasonic sensor will be powered by MSP432. A level shifter will be connected in series with the ultrasonic sensor to convert the 3.3v supplied by MSP432 to 5v,
In addition, the motor driver circuit (motor driver + 2 DC motors) will be powered by a separate 9v rechargeable external battery pack,

Back-of-the-envelope estimate of battery life:

- For MSP432 & servo & ultrasonic sensor:
  5V portable power bank: 5000mAh = 25Wh
  Power consumption =0.1W (MSP432)+ 5V * 0.015A + 5V * 0.15A = 0.108W
  25Wh/0.108W = 231 h
- For motor driver circuit:
  9V battery: 565mAh
  Power consumption = 1.4w * 2 + 36mA * 5V (logic) = 3.01W
  Under 9V, 565/1000/3.01*9 = 1.71h

Component Name	Description	Performance Requirements	Performance Specifications	Power Source	Conditioning and MSP432 Integration
HC-SR04	Ultrasonic Sensor	Range: 5cm - 1m Sampling 1kHz	Range: 2cm - 4m Sampling 40kHz	5V from MSP through level shifter	P6.4 and P6.5 for I2C

Wire diagram: