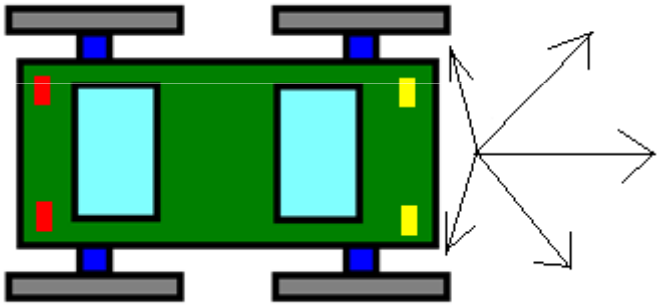
ECE 511: Obstacle Evading Ultrasonic Robot
Final Project Report



Team: Aaron Hunter, Eric Whitestone, Joel Chenette, Anne-Marie Cressin

Fall 2011, ECE Department, George Mason University

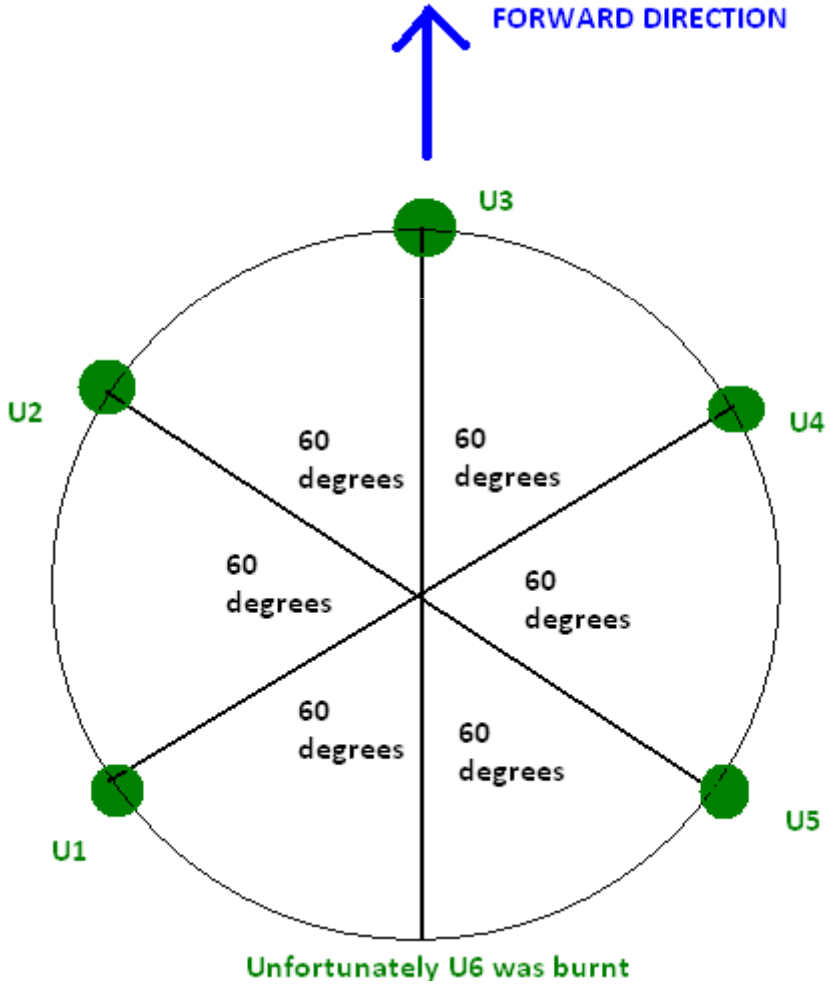
GOAL

- We wanted to use the microcontroller MSP430 to build a small robot that would avoid obstacles.

- To accomplish that goal, we are assembling the MSP430 with 6 ultrasonic range finders, an H-bridge, a servo, and a LEGO platform, and a set of batteries for power.

Placement of Ultrasonic Range Finders

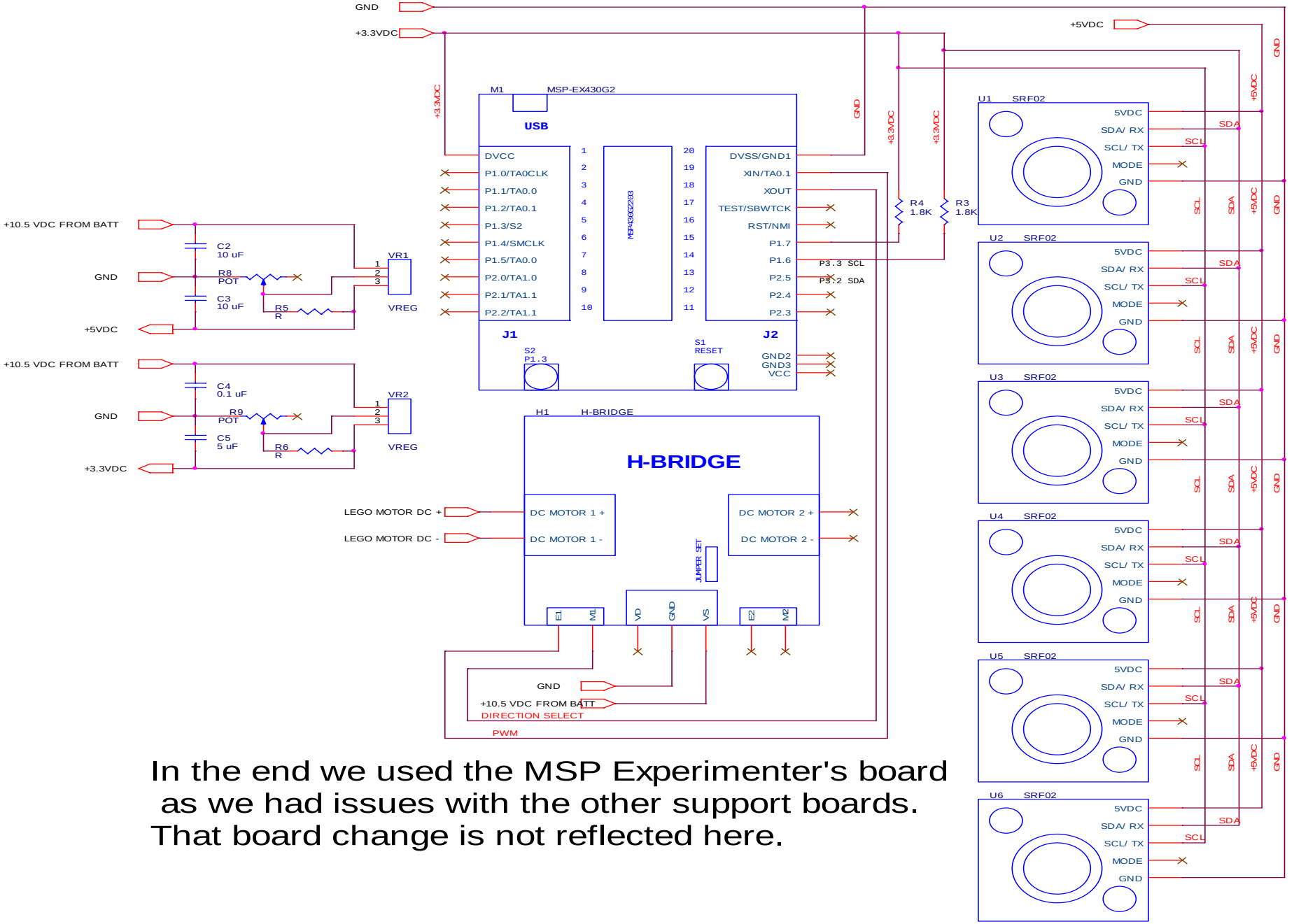
- Originally 6 Sensors
- One sensor was fried



List of Components

Description	Qty	Manufacturer	Manufacturer Part Number	Price per Unit	Total Price
Microcontroller	1	Texas Instruments	MSP430G2203	$2	$2
Ultrasonic Range Finder	6	Devantech LTD	SRF02	$24.50	$147
H-Bridge	1	DFRobot	DRI0002	$22	$22
Steering Servo	1	Hitec	HS-322HD	$10	$10
Voltage Regulator, 5VDC, 3A, with heatsink	1	Linear Technology	LT1085CT-5#PBF	$10	$10
Adjustable Voltage Regulator, used to provide 3.3VDC, with heatsink	1	National Semiconductor	LM317	$5	$5
Random connectors, perfboard, etc…	n/a	n/a	n/a	$20	$20
Set of Batteries	1	n/a	n/a	n/a	n/a
Total Project Cost					**$216**

Overall System Schematic

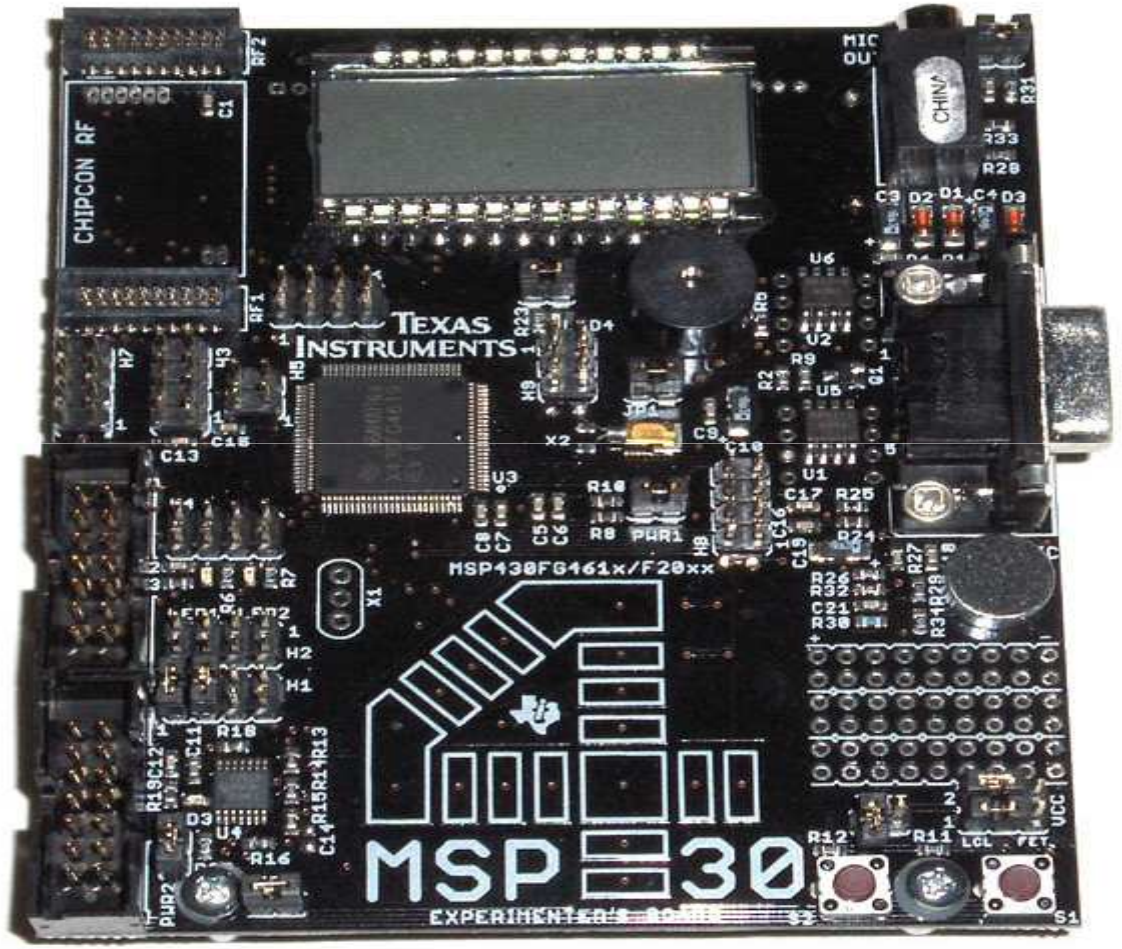


In the end we used the MSP Experimenter's board as we had issues with the other support boards. That board change is not reflected here.

Component #1: Microcontroller

- Unpredictable register values with the Launchpad

- Switched to Experimenter board



TI's Experimenter's Board provides access to a range of interfaces including the ability to plug in a Chipcon wireless module.

Component #2: Ultrasonic sensors

- They detects objects.
- The I2C communication
- Addressing confusion
- 7 Bit address
- Bit shift issue not well documented

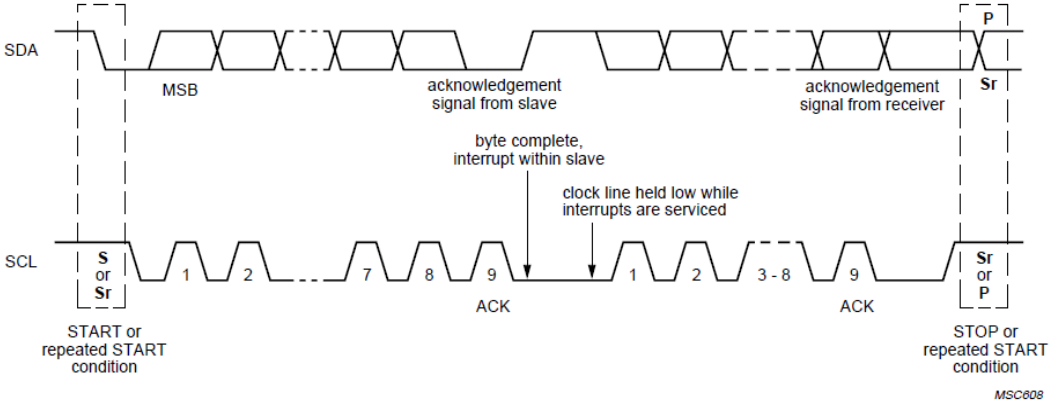


Fig.6 Data transfer on the I²C-bus.

Component #3: H-Bridge

- It powers the wheel motors
  - One pin for direction, another pin for speed control.
  - Direction pin uses a digital I/O pin
  - Speed pin is controlled by Timer hardware
  - Modifying CCR1 changes the PWM duty cycle

Component #4: Steering Servo

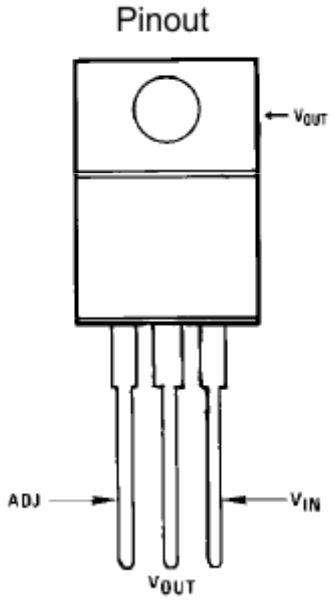
- It gives the robot its orientation (turns it)
  - 3 pin interface: Power, Gnd, PWM input
  - Pulse width from ~1050us to ~1950us, frequency of 50 Hz
  - PWM pin is controlled by Timer hardware
  - Modifying CCR1 changes the PWM dutycycle
  - Challenges: Servo did not have full range of motion. Had to manually tweak the PWM timings

Component #5: Set of batteries

- It powers the robot.
  - 2 Pin interface (PWR, GND)
  - 10.5 V supply voltage

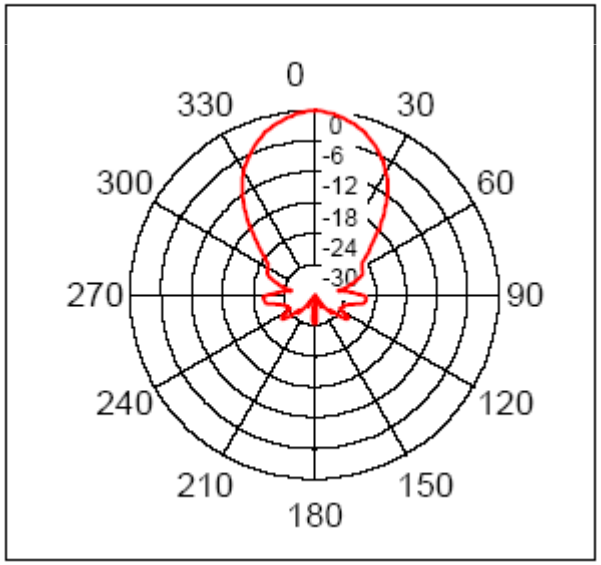
Component #6: Two voltage regulators

- They adjust the battery voltage for MSP and ultrasonic sensors.
  - 3 Pin interface: Vin, Gnd, Vout
  - TO-220 package
  - A heatsink was added for the 5VDC voltage regulator.



Ultrasonic Sensors Characteristics

- Each range finder has a beam pattern as shown below, with the sensitivity of the transducer in db.



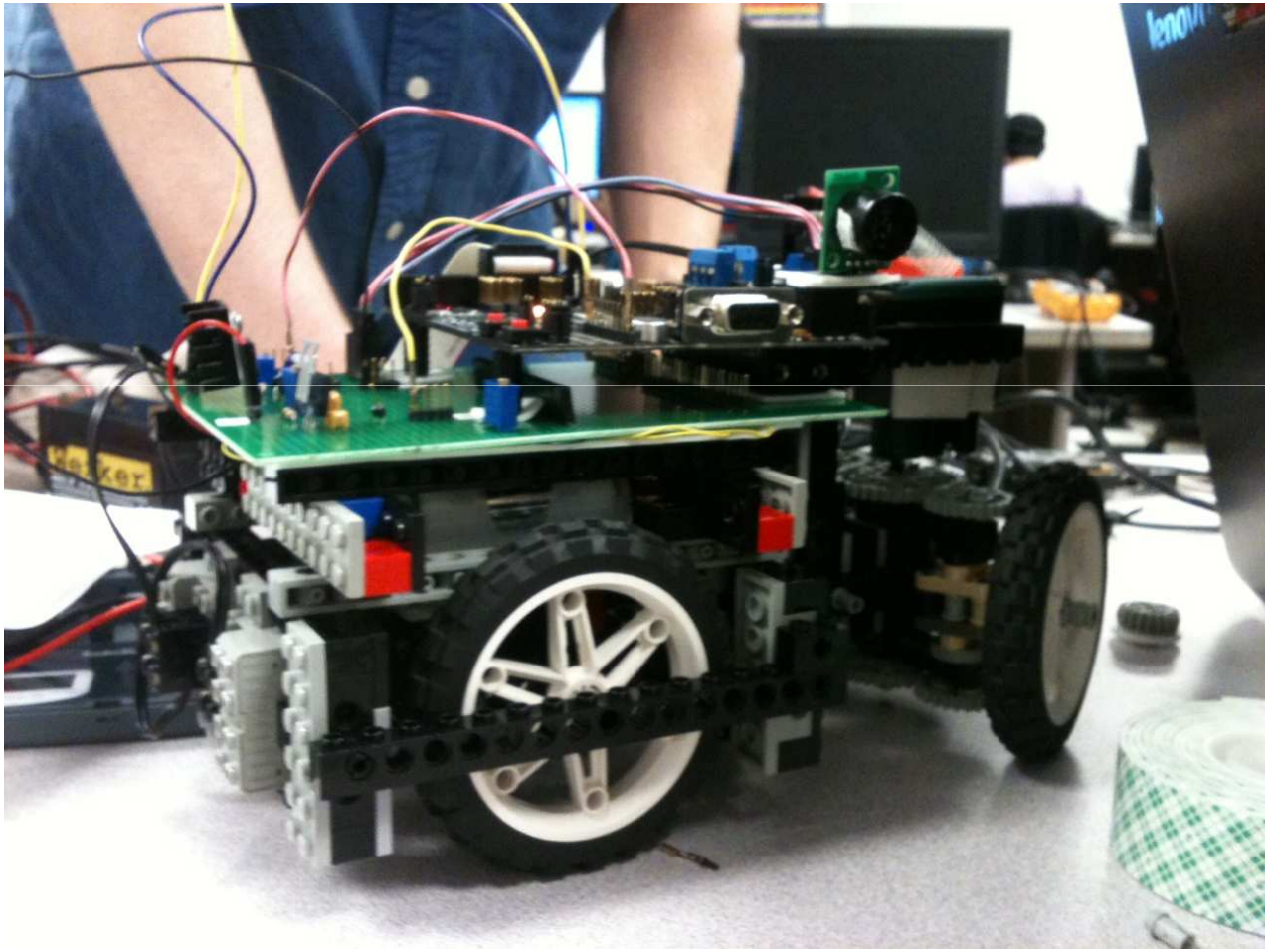
Division of Tasks among members

- I2C Development: Eric Whitestone and Joel Chenette
- Electrical Integration: Anne-Marie Cressin
- Power and Steering Development: Aaron Hunter
- Hardware Integration: Aaron Hunter and Anne-Marie Cressin

Adjustments to Scope of Work

- As mentioned before, we used the MSP430 Experimenter's Board in the end as we had encountered too many issues with the other support boards.
- No PCB was finalized as the board changes did not give enough lead time for a PCB to be fabricated.
- Five ultrasonic sensors are being used instead of six.

Our robot



Thank you!