ECE 511
SNIFFING DOG

Under the guidance of

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Team Members:

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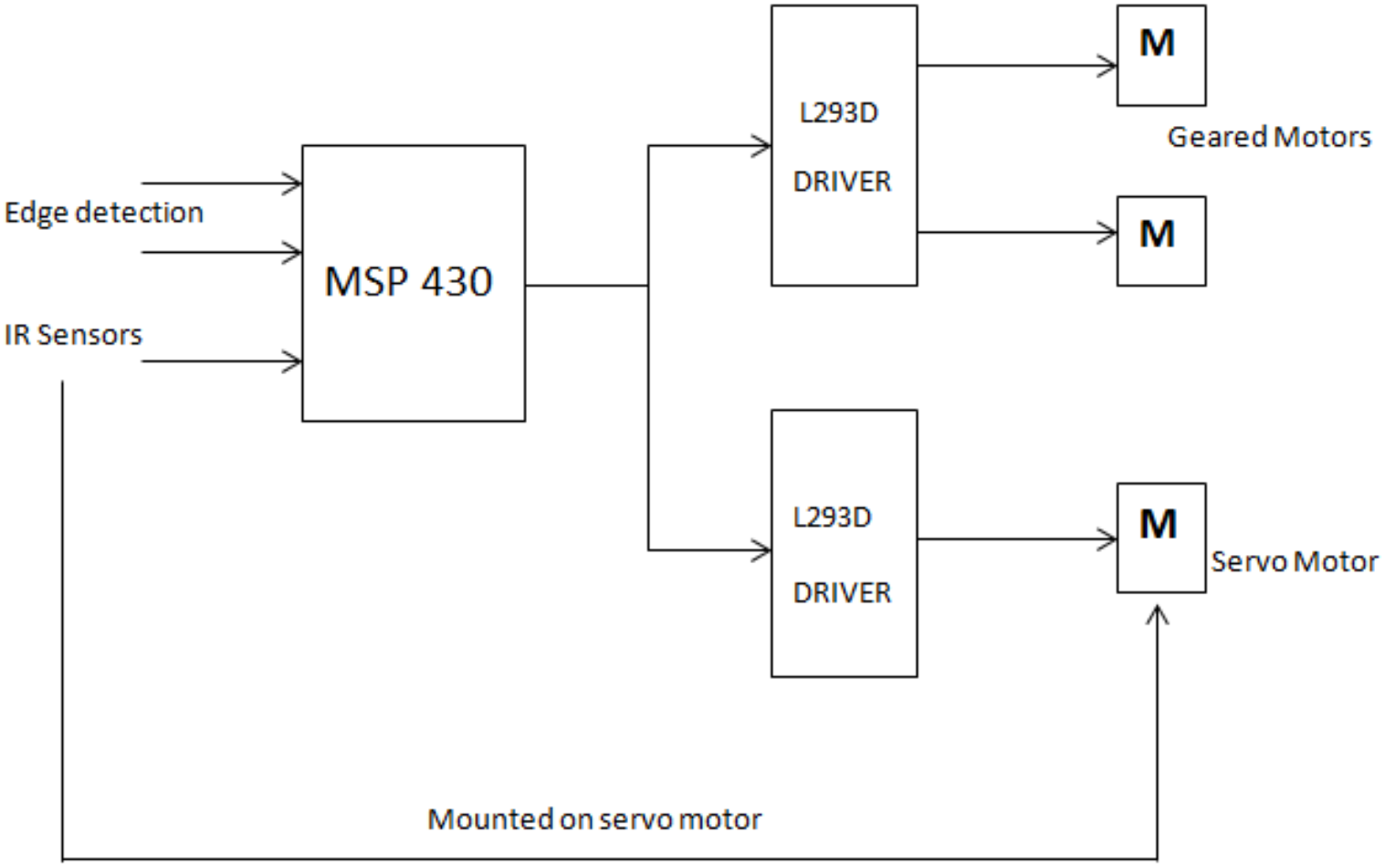
Overview:

* Built a robot that replicates a sniffing dog
* The dog moves in right or left direction according to the movement of object
* Depending on the distance between them, the dog makes a decision to move forward or backward
* When moving on a platform, in order to make sure it doesn't fall off, we have implemented edge detection technique
* It was an opportunity to demonstrate interfacing capabilities of multiple components.

Hardware components list:

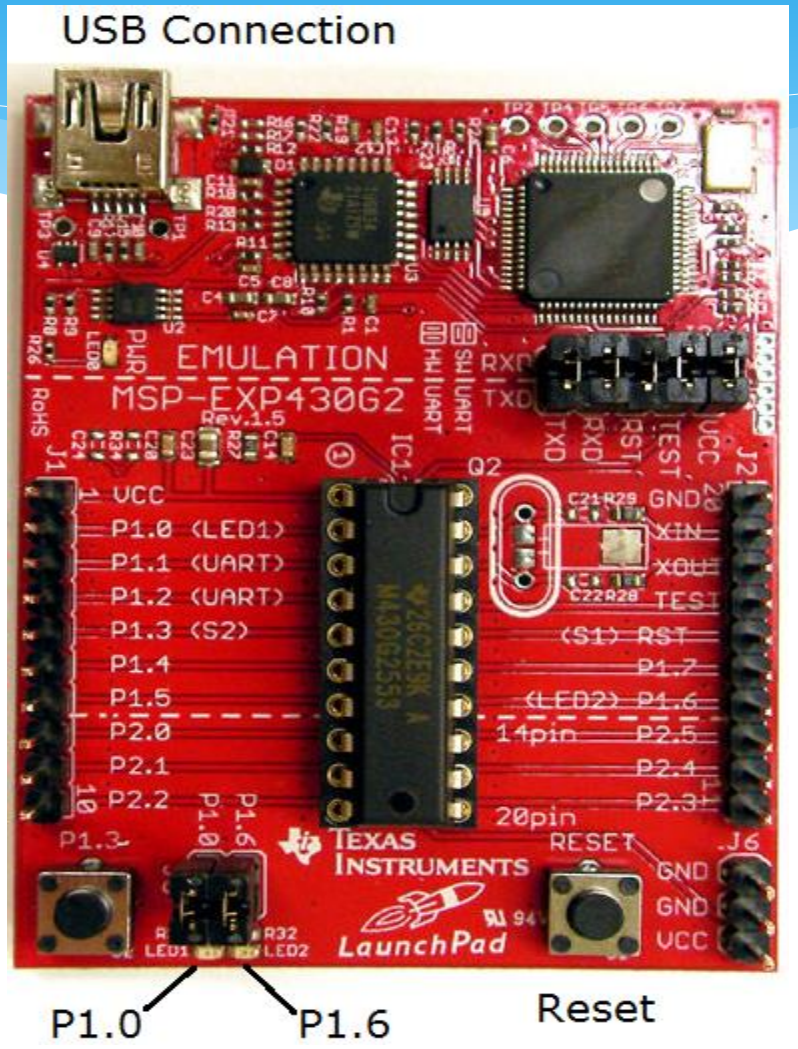
* TI MSP430G2553 microcontroller
* Two Geared Motors
* Servo Motor
* Sharp Analogue Infra-Red Range Finding System (AERS)
* Two pairs IR Sensors
* Two L293D drivers
* Three 270 Ω Resistors
* Four 10KΩ Resistors
* Battery holder
* AA batteries

Block Diagram:



TI MSP430G2553:

* Heart of the circuit, holds the logic to run each of the peripherals
* Low Supply-Voltage Range: 1.8 V to 3.6 V
* Ultra-Low Power Consumption: Active mode- 230 µA at 1 MHz, 2.2 V
* 10-Bit 200-ksps Analog-to-Digital (A/D)With Internal Reference
* 16-Bit RISC Architecture
* Two 16-Bit Timers
* Operating Frequency: 16MHZ



IR Sensor:

* Model: 276-0142
* This is used for edge detection purpose, placed in the front and rear part of the body
* Interface:

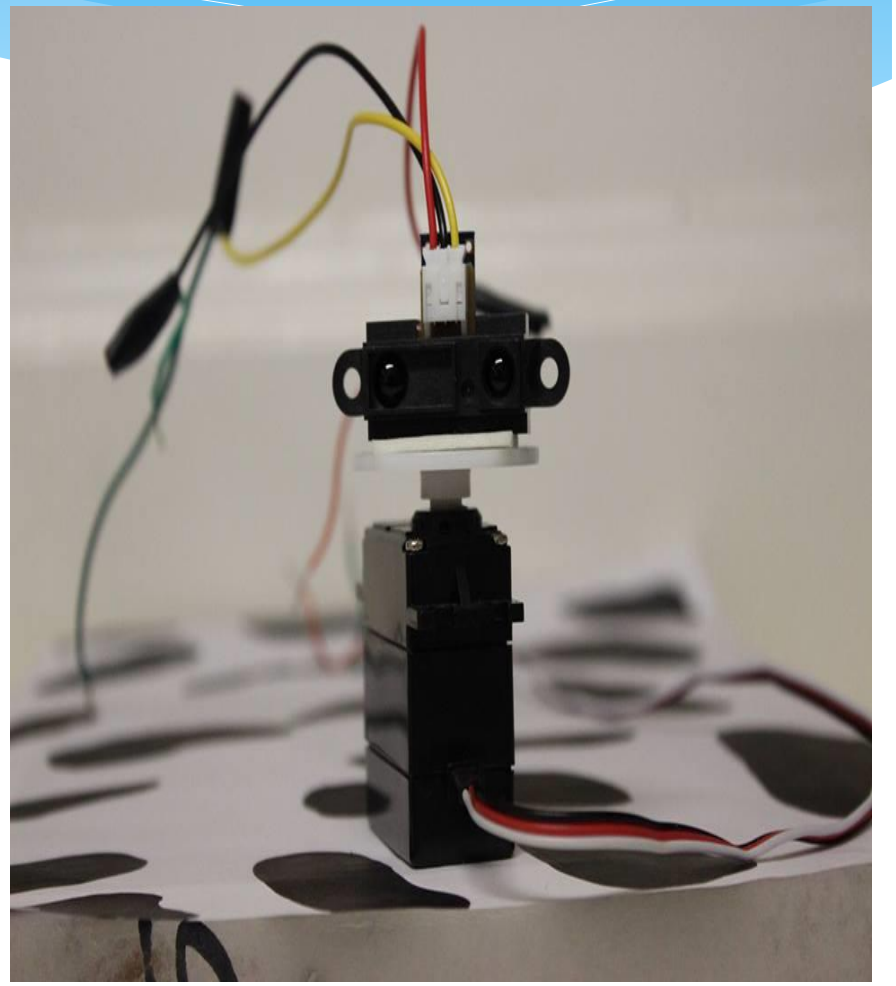
  Output via pin P1.5 and P1.6

Sharp Analogue Infra-Red Range Finding System (AERS):

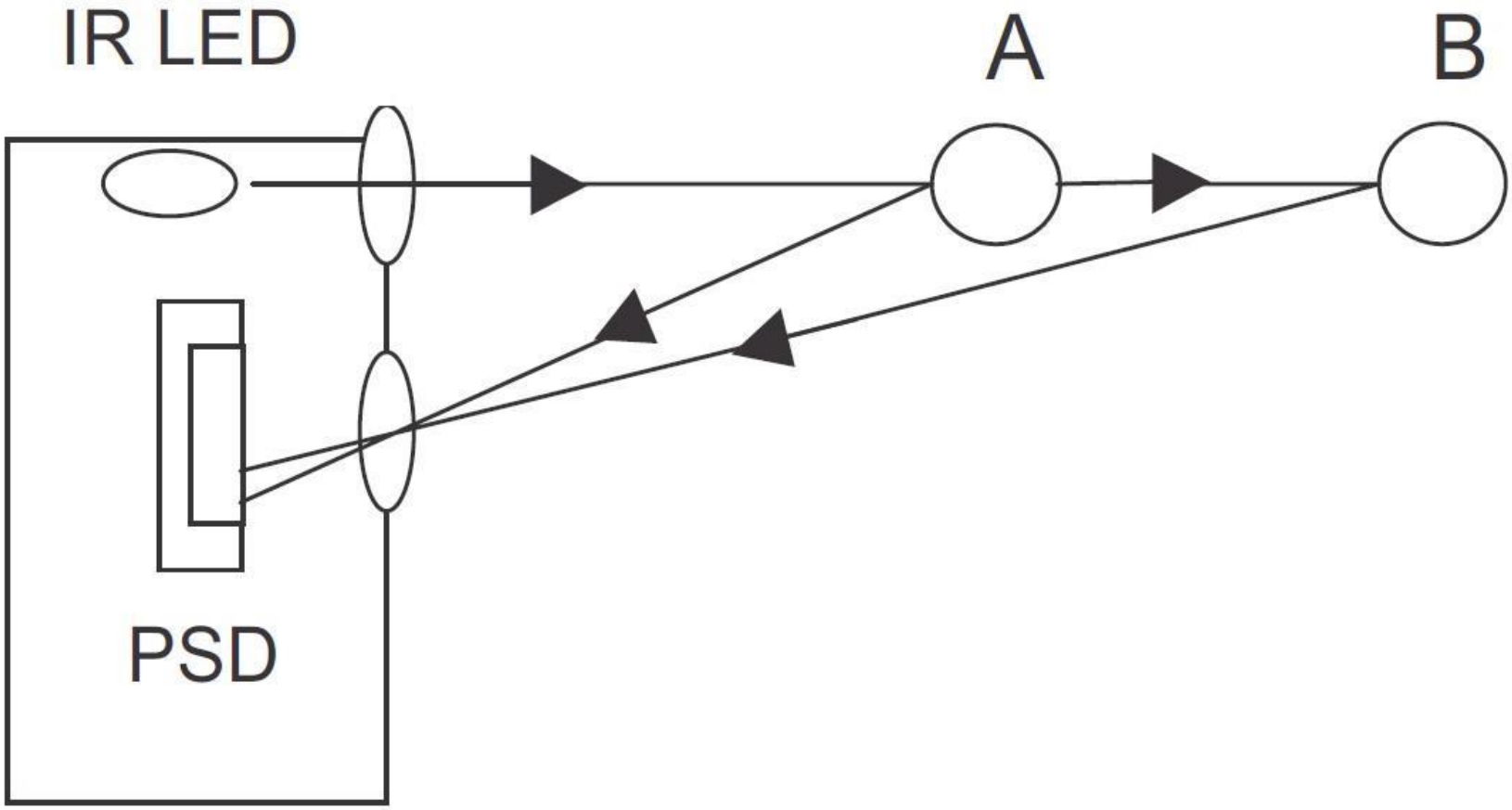
* Model :
  35080 Sharp GP2Y0A21YK0F

* Specs :
- Range: 10 cm to 80cm
- Output Voltage Range:

  2V to 0.2V
- This is used to check the proximity of the object.
- Output via pin P1.7

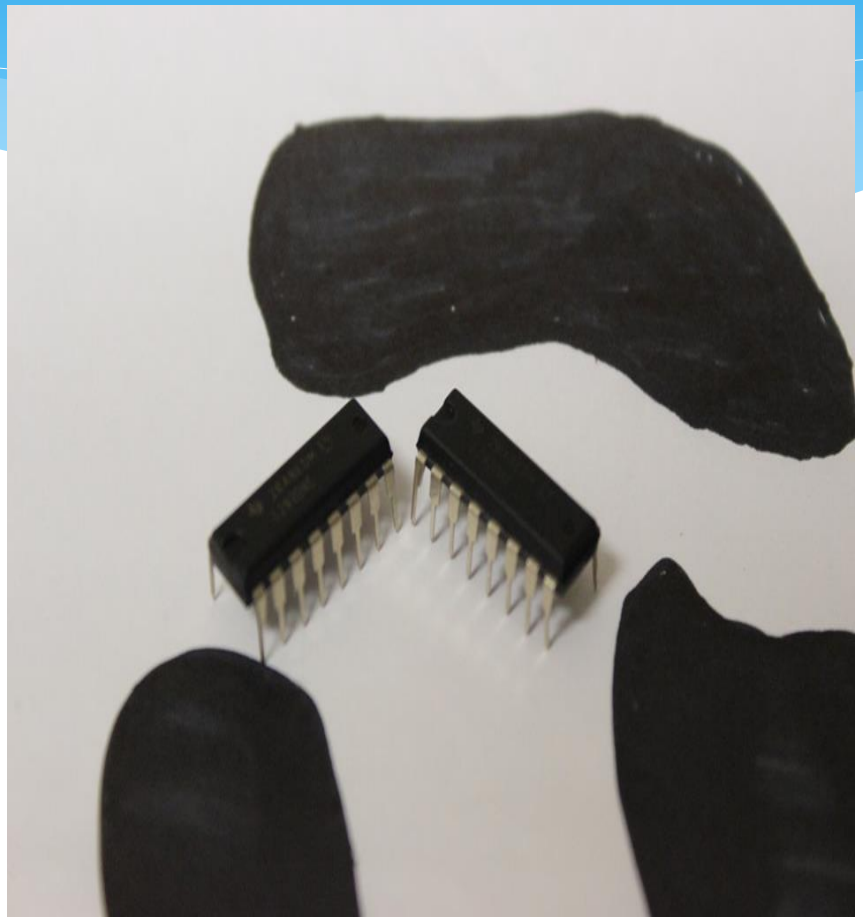


IR Sensors: Working



L293D Driver:

* We are using 2 drivers.
* This is the driver IC used to drive the Servo and Geared motors.
* Directly interfaced with MSP430.



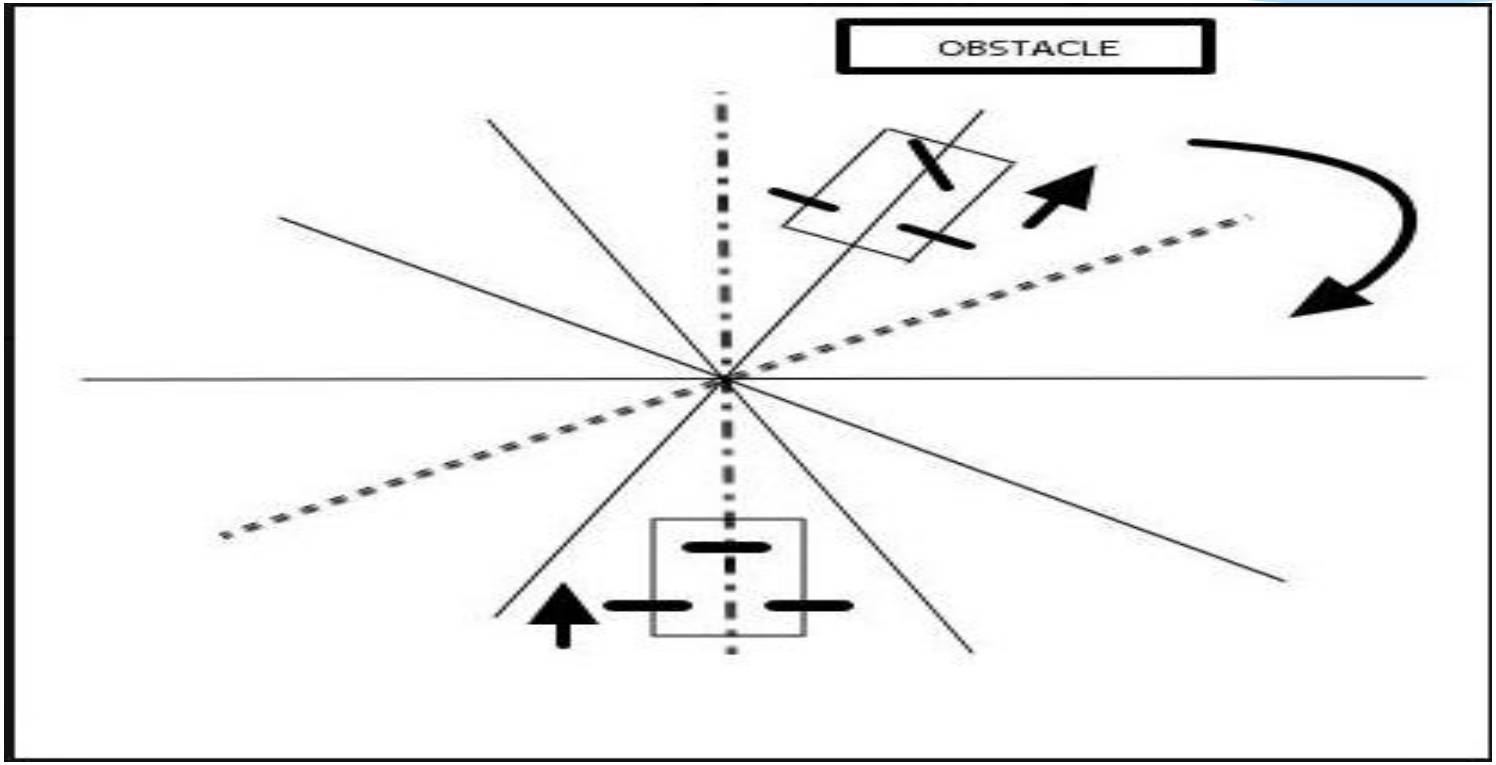
Geared Motors:

- Model : GM-9
- Specs :
  - 400mA max current
  - 40RPM at 3V
  - 7mm double-flat output shaft
- Interface :
  - Output via P2.0,P2.1,P2.3 and P2.4
  - 4.8V voltage source

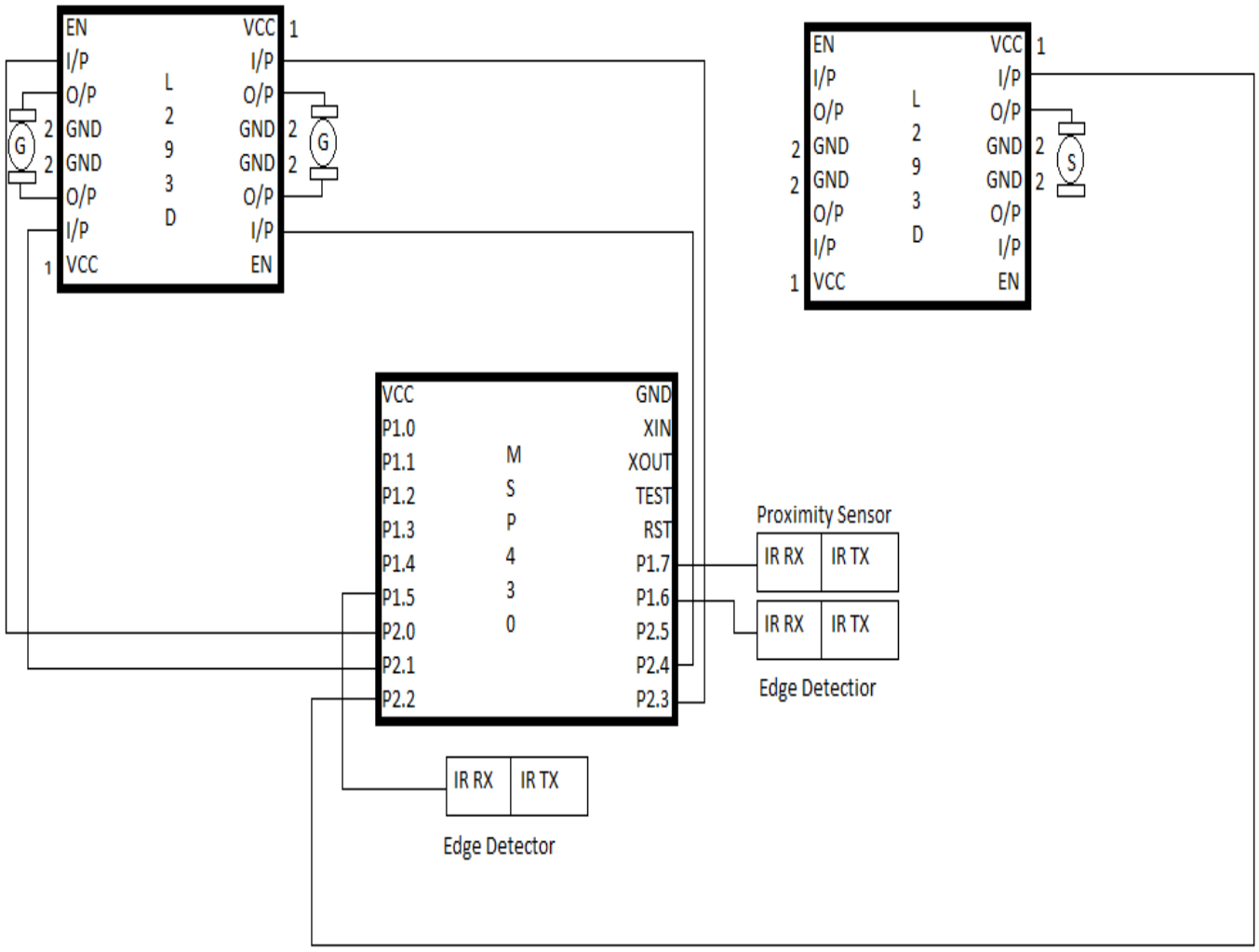
Servo Motor:

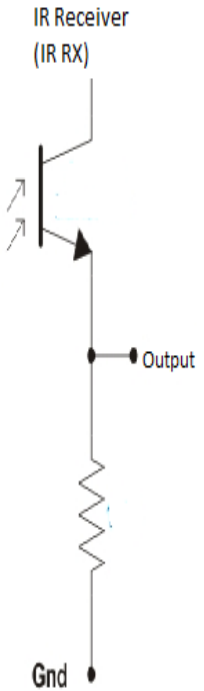
* Model : S03 – N
* Specs :
  * Speed (sec/60deg) : 0.23
  * Torque (Kg-cm/Oz-in) : 2.40/35
  * Size (mm) : 39.5x20x39.6
  * Weight (g/oz) : 41/1.44
* Interface :
  * PWM Output via pin P2.2

Servo Motor:



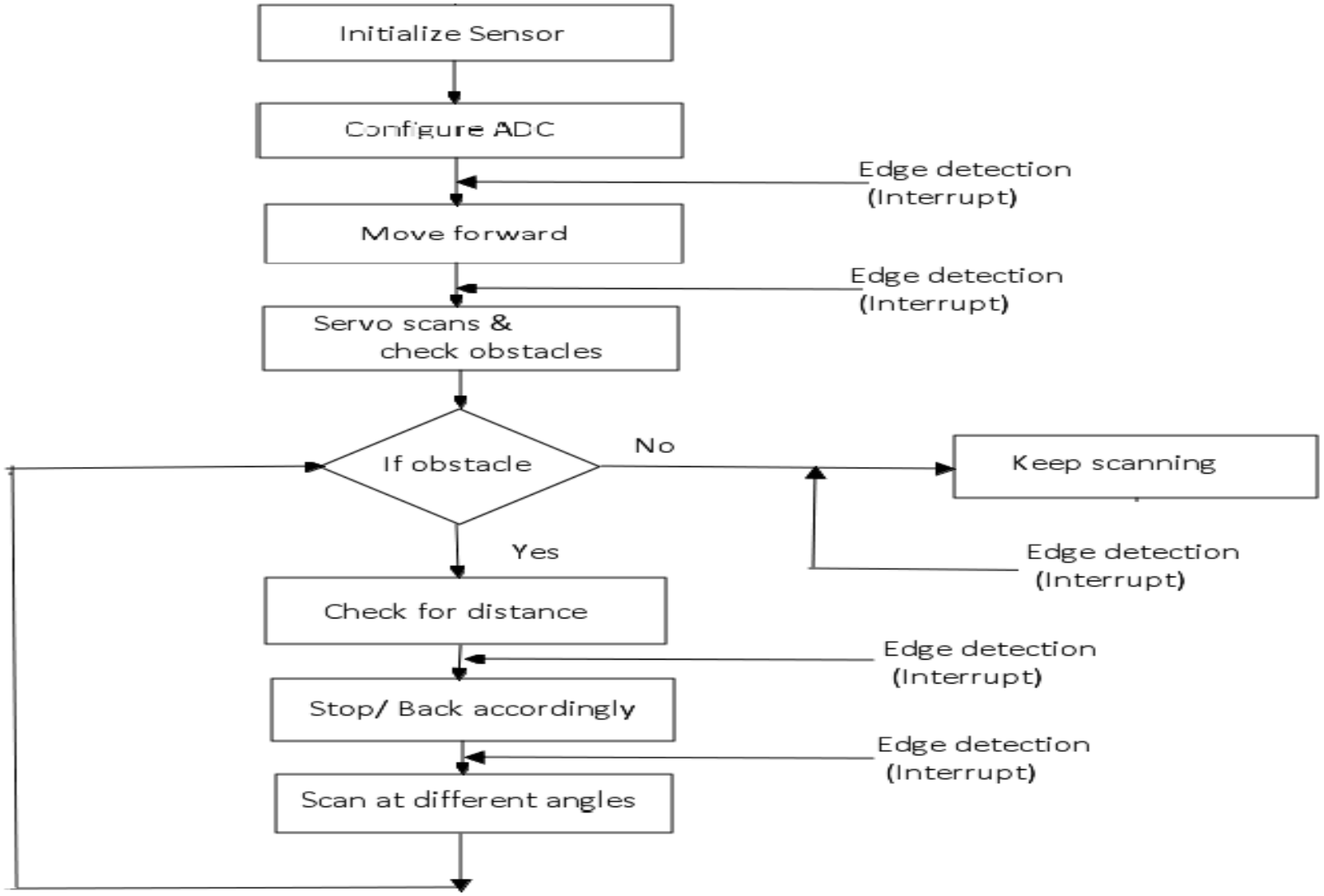
Hardware Schematic:





1	VCC
2	GND
G	Geared Motor
S	Servo Motor

Software Flow Chart:



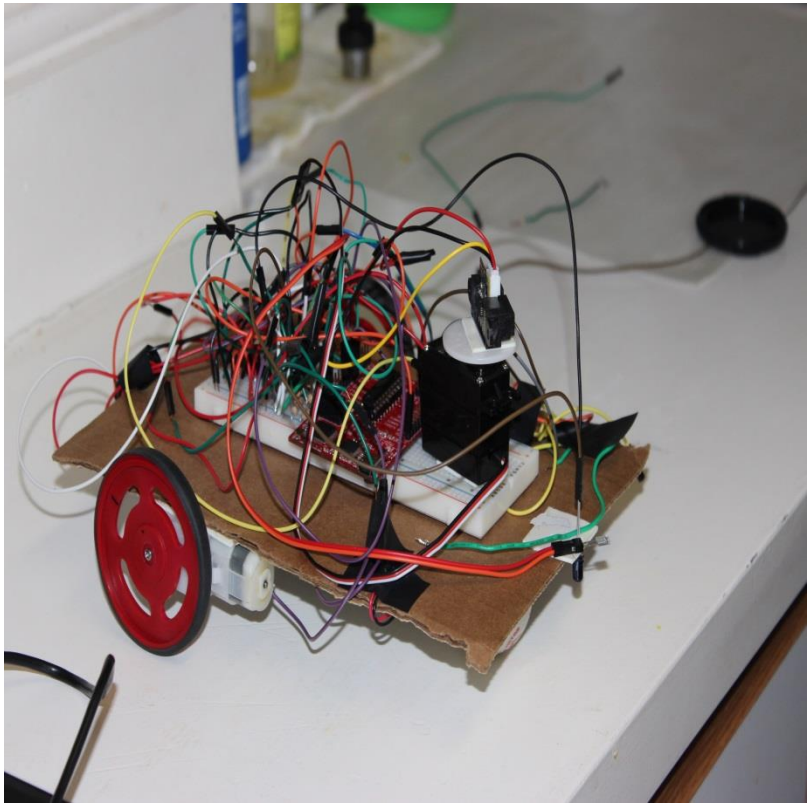
Result:

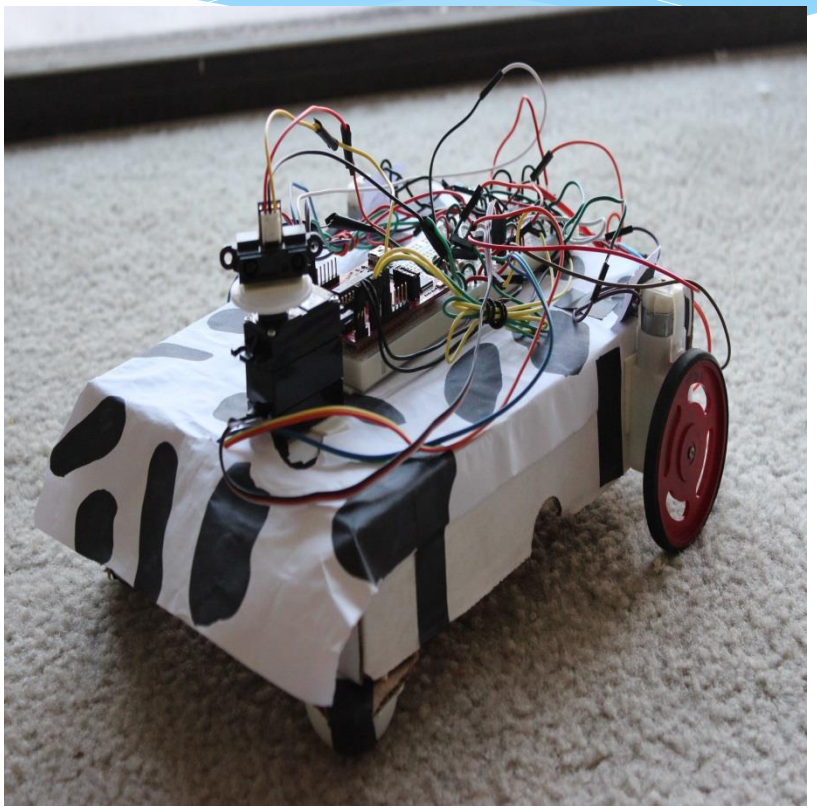
* We have built the Sniffing Dog as specified:
  * Dog move forward in search of the object scans simultaneously in search of the object
  * Once it detects object using the range finder, the dog stops and aligns with the object
  * It then scans again to check if the obstacle is still at the sam position.
  * Then depending on the distance of the object, it sniffs by moving forward and if the object is too close, it moves back.
  * It does edge detection to ensure that it does not fall off a table

Challenges:

* It was difficult to calibrate the distances to set the minimum threshold and maximum detectable range
* It was difficult to exactly actuate the amount of turning angle on the geared motor to a proportionate angle detected by the servo
* Integrating Edge detection

Demonstration:





Task Division:

* Gear motor standalone testing and interfacing - Shashwath and Ranjit.
* Servo motor standalone testing and interfacing - Vignesh and Preethi.
* IR sensor standalone and interfacing - Swathi.

Reference:

* http://courses.cs.washington.edu/courses/cse466/11au/calendar/04-Interrupts-posted.pdf
* http://www.ti.com/product/msp430g2553
* http://mitchtech.net/msp430-launchpad-pwm/
* http://e2e.ti.com/group/microcontrollerprojects/m/msp430microcontrollerprojects/494158.aspx
* http://batchloaf.wordpress.com/2012/09/28/basic-example-program-for-msp430g2231/
* http://myweb.wit.edu/johnsont/Classes/462/ADC%20for%202%20sensors.htm
* http://www.uniobuda.hu/journal/Kuljic_Simon_Szakall_17.pdf


THANK YOU