Mobile Robotics Test # 2 Code

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File 1: main.c

```
#include <avr/io.h>
#include <stdio.h>
#include "serial.h"
#include "pwm.h"
#include "ir.h"
#include "pd.h"

#define MAX_SPEED 1650
#define DESIRED_SPEED 1700
#define MIN_SPEED 1720

int fitInBounds(int val) {
        val = (val < MAX_SPEED) ? MAX_SPEED : val;
        val = (val > MIN_SPEED) ? MIN_SPEED : val;

        return val;
}

int main(void) {
        serialInit();
        pwmInit();
        irInit();

        int setPoint = 32;

        char tempString[30];
        int rMotorSpeed = DESIRED_SPEED;
        int lMotorSpeed = DESIRED_SPEED;

    while (1) {
                uint16_t irval = irLinRead();

                int pd = pdCalc(irval, setPoint);

                lMotorSpeed = DESIRED_SPEED - pd/2;
                rMotorSpeed = DESIRED_SPEED + pd/2;
                lMotorSpeed = fitInBounds(lMotorSpeed);
                rMotorSpeed = fitInBounds(rMotorSpeed);
                pwmSet(LEFT_MOTOR, lMotorSpeed);
                pwmSet(RIGHT_MOTOR, rMotorSpeed);

                sprintf(tempString, "%d\n\r", (irval - setPoint));
                serialPrint(tempString);

    }
}
```

File 2: serial.h

```
/*
 * serialFcns.h
 *
 * Created: 3/1/2019 2:33:15 PM
 *  Author: colemanct
 */


#ifndef SERIAL_H_
#define SERIAL_H_

void serialInit();
void serialPrint(char* str);

#endif /* SERIALFCNS_H_ */
```

File 3: serial.c

```
/*
 * serialFcns.c
 *
 * Created: 3/1/2019 2:32:30 PM
 *  Author: colemanct
 */
 #include <avr/io.h>

void serialInit() {
        UBRR0H = (unsigned char)(103 >> 8);
        UBRR0L = (unsigned char)(103 & 0xFF);

        UCSR0B |= (1 << RXEN0)|(1<<TXEN0);
}

void serialPrint(char* str) {
        int i = 0;
        do {
                while((UCSR0A & (1 << UDRE0)) == 0) {}
                UDR0 = str[i];
                i++;
        } while(str[i] != '\0');
}
```

File 4: pwm.h

```
/*
 * pwm.h
 *
 * Created: 4/3/2019 3:18:17 PM
 *  Author: colemanct
 */


#ifndef PWM_H_
#define PWM_H_

#define RIGHT_MOTOR 1
#define LEFT_MOTOR 2

void pwmInit();
void pwmSet(int motor, int usHigh);

#endif /* PWM_H_ */
```

File 5: pwm.c

```
/*
 * pwm.c
 *
 * Created: 3/6/2019 2:52:12 PM
 *  Author: colemanct
 */
#include <avr/io.h>

void pwmInit() {
        DDRD |= (1 << DDD6);
        DDRD |= (1 << DDD5);
        OCR0A = 0;
        OCR0B = 0;
        TCCR0A |= (1 << COM0A1);
        TCCR0A |= (1 << COM0B1);
        TCCR0A |= (1 << WGM01) | (1 << WGM00);
        TCCR0B |= (1 << CS02) | (1 << CS00);
}

void pwmSet(int motor, int usHigh) {
        if (motor == 1)
                OCR0A = usHigh / 78;
        else if (motor == 2)
                OCR0B = usHigh / 78;
}
```

File 6: ir.h

```
/*
 * ir.h
 *
 * Created: 4/3/2019 3:22:30 PM
 *  Author: colemanct
 */


#ifndef IR_H_
#define IR_H_

#define IR_PIN  0

void irInit();
uint16_t irRead();
uint16_t irLinRead();


#endif /* IR_H_ */
```

File 7: ir.c

```
/*
 * ir.c
 *
 * Created: 4/3/2019 3:22:19 PM
 *  Author: colemanct
 */
 #include <avr/io.h>

void irInit() {
        ADMUX |= (1 << REFS0);
        ADCSRA |= (1 << ADPS2)|(1 << ADPS1)|(1 << ADPS0);
        DIDR0 |= (1 << ADC0D);
        ADCSRA |= (1 << ADEN);
}

uint16_t irRead() {
        ADCSRA |= (1 << ADSC);

        while ( (ADCSRA & (1 << ADSC)) );

        return ADC;
}

uint16_t irLinRead() {
        uint16_t val = irRead();

        return (10000/val);
}
```

File 8: pd.h

```
/*
 * pd.h
 *
 * Created: 4/6/2019 5:19:47 PM
 *  Author: colemanct
 */


#ifndef PD_H_
#define PD_H_

int pdCalc(int input, int setPoint);

#endif /* PD_H_ */
```

File 9: pd.c

```
/*
 * pd.c
 *
 * Created: 4/6/2019 5:19:34 PM
 *  Author: colemanct
 */

#include <avr/io.h>
#include <stdio.h>

#define kp 10
#define kd 10

int previousError = 0;

int pdCalc(int input, int setPoint) {
        int error = setPoint - input;
        int diff = error - previousError;

        int ret = (int)(kp*error + kd*diff);

        previousError = error;

        return ret;
}
```