

# Autonomous Map Plotter of a Room

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## **Objective :**

The Objective of this project is to plot the outline of a room on matlab .

## **Abstract :**

In this project we are going to make a robot which moves along the wall of a room and plots the path it is going , thereby giving the shape of the room. For now we are assuming that the given room has only right angled edges .

The path of the robot will be displayed on the laptop through matlab interface.

## **Hardware and Software Requirements :**

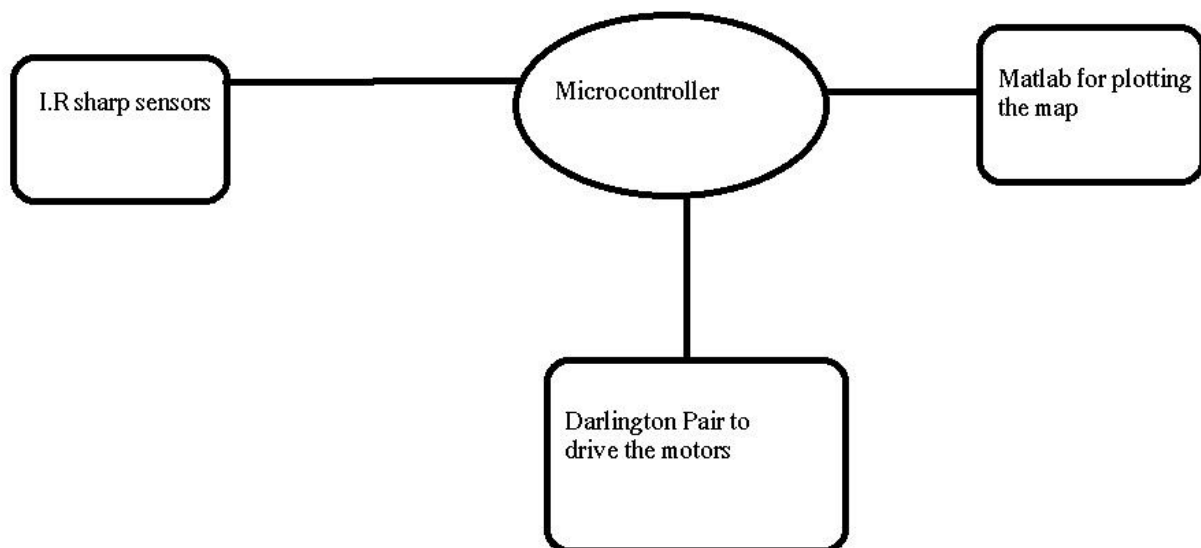
- ➔ ATMega16 and bootloader kit
- ➔ Ir sharp sensors
- ➔ Chassis with wheels and motors
- ➔ Power source (battery)
- ➔ Laptop ( matlab Interface)

### Working Procedure :

First the bot will start at one end of a room and moves along the wall and it will continuously receive the data from the IR sharp sensors which will be given to the laptop using a microcontroller and there by plotting the map in the laptop.

Microcontroller will give a constant data unless it encounters a signal from the sensors. When the bot encounters a turn or an edge the sensor will give a signal to the microcontroller , so the microcontroller stores a different data bit. If it moves straight then we will store a character “s” in a array . If it goes left then the character “l” , if it goes right then the character “r”.

### Block Diagram :



## **Modules And Description :**

There are four modules in this project :

- 1) Sensor module
- 2) Microcontroller
- 3) Motor Controller
- 4) Matlab

### **Sensor Module :**

We used IR sharp sensors to follow the wall in this project. The sharp sensors give different analog values based on the distance of the object from it . Therefore by using the sensor values microcontroller will suitably give values for motors to move.

### **Microcontroller :**

The microcontroller takes the analog data from the the three I.R sharp sensors and converts it into digital values. Based on the digital values the signals to the motors are controlled. The code of the microcontroller is as follows.

```
int main(void)

{

    LCD_init();

    _delay_ms(10);

    DDRA=0xF0;

    DDRB=0xFF;

    DDRD=0x00;

    ch[0]='s';

    i1=1;

    int i=0,k=0,state=0,state1=0,state2=0;

    UART_init(77);

    sei();

    while(1)
```

```

{

    if(init==0)

    {

        while(1)

        {

            PORTA=0x00;

        }

    }

    LCD_send(0x01,0);

    ADC_SINGLE_CONVERSION1();

    ADC_SINGLE_CONVERSION2();

    if(data1 >= 480)

    {

        ch[i1]='r';

        i1++;

        while(1)

        {

            LCD_send_string("loop1");

            if(data2<150)

                break;

            if((data2>600 && data1<100 &&
state==1)&&(data3<400&&data3>300))

            {

                break;

            }

            ADC_SINGLE_CONVERSION1();

```

```

        ADC_SINGLE_CONVERSION2();

        ADC_SINGLE_CONVERSION3();

        PORTA=0b00100000;

        _delay_ms(50);

        PORTA=0b00000000;

        _delay_ms(100);

        if(data3<300)

            state2=1;

            if(data2>250&&data2<300)

                {

                    state=1;

                }

            if(init==0)

                {

                    while(1)

                        {

                            PORTA=0x00;

                        }

                }

        }

        state=0;

        state2=0;

    }

    if(data2<100 && state1==0)

    {

```

```

ch[i1]='l';

i1++;

while(1)

{

ADC_SINGLE_CONVERSION3();

PORTA=0b10000000;

_delay_ms(70);

PORTA=0b00000000;

_delay_ms(100);

    if(data3>450&&data3<500)

        state3=1;

    if(data3>=550&&state3==1)

    {

        state3=0;

        state1=1;

        break;

    }

    LCD_send_string("loop");

    if(init==0)

    {

        while(1)

        {

            PORTA=0x00;

        }

    }

```

```

        }

    }

    if(data2>=500 && state1==1)
    {
        state1=0;
    }

    if(i%10==0)
    {
        ch[i1]='s';
        i1++;
        i=0;
    }

    i++;

    PORTA=0b10100000;

    _delay_ms(100);

    PORTA=0b00000000;

    _delay_ms(100);

}

}

```

### Motor Controller :

The signals from the microcontroller are given to the base of the base of the transistors of darlington pair. We used darlington pair instead of H bridge as it is getting heated .

### Matlab

The array for plotting the room will be given to the matlab using Usart Interface . The code of Microcontroller for sending to matlab using Usart is as follows. The USART strts execution when an interrupt occurs (i.e when we write character “a” to it).

```
ISR(USART_RXC_vect)
{
    rec = UDR;
    int j=0;
    if(rec=='a')
    {
        while(1)
        {
            if(ch[j]=='\0')
            {
                ch[j]=0;
                USART_TRANSMIT(ch[j]);
                break;
            }
            USART_TRANSMIT(ch[j]);
            j++;
        }
        while(1)
        {
            PORTA=0x00;
        }
    }

    sei();
}
```



And the Matlab code for plotting is as follows

```
function [] = mapplot(data)

i=2;

x=[];

y=[];

%px=1;

%py=1;

%kx=1;

%ky=1;

x(1)=1;

y(1)=1;

while(1)

    if data(i)==0

        break;

    end

    %px=px+1;

    if data(i)==115%going straight

        x(i)=x(i-1)+1;

        % px=px+1;

        y(i)=y(i-1);

    end

    if data(i)==114%after taking right

        x(i)=x(i-1);

        y(i)=y(i-1)-1;
```

```

i=i+1;
while(1)
    if data(i)==0
        break;
    end
    if data(i)==108%taking left after taking right
        break;
    end
    if data(i)==115%going straight after right
        x(i)=x(i-1);
        y(i)=y(i-1)-1;
    %    py=py+1;
    end
    if data(i)==114%taking right after right
        x(i)=x(i-1)-1;
        %    px=px+1;
        y(i)=y(i-1);
    end
    i=i+1;
end
end
if data(i)==108%taking left
    x(i)=x(i-1)+1;
    y(i)=y(i-1);

```

```

i=i+1;

while(1)

    if data(i)==0

        break;

    end

    if data(i)==115%going straight after left

        x(i)=x(i-1)+1;

        y(i)=y(i-1);

    end

    if data(i)==114%going right after left

        x(i)=x(i-1);

        % px=px+1;

        y(i)=y(i-1)-1;

    end

    if data(i)==108%going left after left

        x(i)=x(i-1);

        y(i)=y(i-1)+1;

    end

    i=i+1;

end

end

if data(i)==0

    break;

```

end

i=i+1;

end

plot(x,y)

end

### **Problems Faced :**

- 1) There is a problem with the two motors , they are not moving at the same speed , so they are getting diverted from their normal path.
- 2) There is a problem with the motor controller , it is getting heated , as the motors are drawing more current.

### **Solutions :**

- 1) The first problem can be solved by taking feedback (i.e using PID) but we need to a some mechanical changes to our bot , so we tried to minimize the problem in the code itself.
- 2) The H bridge problem is solved by using darlington pair which has got more gain and is not getting heated.

### **Applications :**

Can be used to know the area of a room and its dimensions etc.