

Object Avoidance Robot

The oxford dictionaries definition of ‘autonomous’ is ‘Denoting or performed by a device capable of operating without direct human control.

An autonomous car is a car that can drive itself, park itself and make crucial problem solving calculations to decide what manoeuvre to make next based on practicality, speed, efficiency and safety.

A fully autonomous vehicle would be a safer driver than a human. This is an invention that will change the world as we know it.

Aims and objectives

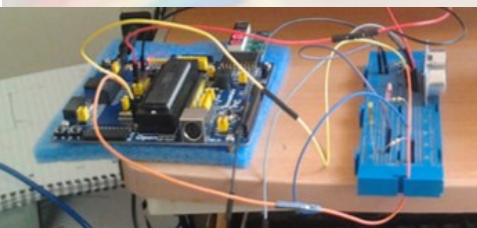
Investigate the electronic theory of an autonomous vehicle.

Main Objective: To design and build an autonomous car that can drive while avoiding obstacles in its path and manoeuvring around them.

Ultrasonic Sensors

Ultrasonic sensors can be used in autonomous devices for ‘seeing’. The ultrasonic technology can enable devices to have depth perception of its surrounding area for up to 2 meters.

I developed the code for the ultrasonic model on MPLAB, the code that was developed was just for distance measurements, a seven segment LED display was used to show to measurements live. To the left is a sample peace of code.

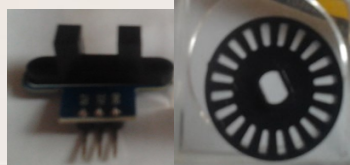


```
////// GENERATES ULTRASOUND SIGNAL //////////////////////////////////////
TRIG = 1; //this turns the pin high and starts the ranging module
delay_us(10); //the delay time to keep the signal on to send the pulse
TRIG = 0;

while(!ECHO)
{
    //Waiting for the Echo
    //////////////////////////////////////
    TMR1ON = 1; //Timer Starts
    //-----
    while(ECHO)
    {
        //Waiting for Echo goes LOW
        //////////////////////////////////////
        TMR1ON = 0; //Timer Stops
    }
}
```

IR Slotted Optocoupler and Motor

This consists of an infrared module with three pins VCC, GND and DOUT. When the beam is broke the sensor will turn on the signal indicator and DOUT will go "HIGH" or else the indicator will be off and DOUT will be "LOW". These aloud me to be able to control the distance that car travelled. The main outputs are the two electric motors that drive the robot. Shown below is one of the motors attached to a wheel, the slotted encoder was attached to

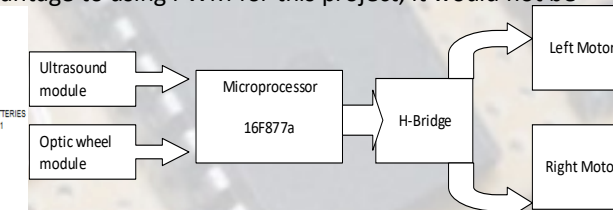
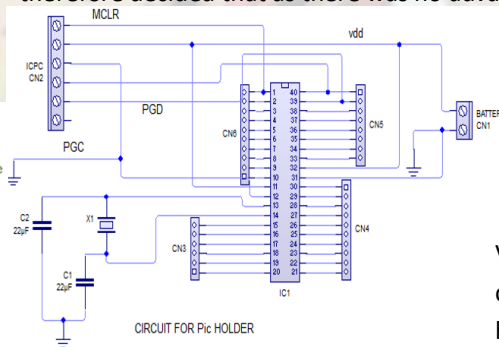


```
FORWARD_left = 1;
BACK_left = 0;
FORWARD_right = 1;
BACK_right = 0;

while(1)
{
    if(WHEEL_TURNS)
    {
        countWheelTurn++;
    }
    else if (!WHEEL_TURNS);
    {
        timeOutDelayLoop++;
        delay_ms(10); //calculated at 4.8ms per slot and 9.6ms per transition
    }
}
```

PWM

In practice it was found that using a PWM input had no advantage. The motors used, as previously mentioned, are budget devices. It was found that below 75% the motors did not run at all. The PWM signal did run the motors between 80% and 100%, but this made no practical difference to the project aims. A drawback to using PWM was that the PIC 16F877a, that was being used, only produces a PWM signal on two output pins. So only the forward or reverse could be controlled, but not both with PWM. Also, the drives would be constricted and could only use particular pins. It was therefore decided that as there was no advantage to using PWM for this project, it would not be



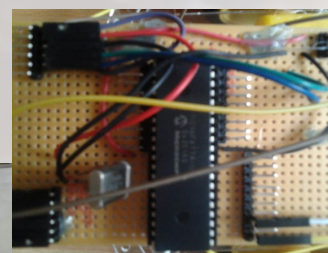
Veroboard was used and some single row curved connectors to make-up a power source distribution hub. This supplies the power from the batteries to the

different devices on the car.

Veroboard was also used to build a circuit as a holder for the PIC microcontroller.

Test 1—The first test was to make the car go forward by a set distance. In order to do this a code was written to tell it to count a set number of ‘HIGH’ on the optical wheel input.

We know there are 20 slots in the wheel and the wheels circumference is about 20cm, there for if we wanted the car to travel 80 cm we just set the code to count 80 highs and then stop. The test



The PIC microprocessor cannot directly drive the motor, so a dual H-Bridge module is used to interface between the PIC and the motors. A “H bridge” is an electronic circuit that switches the polarity of a voltage applied to a load. The dual H-Bridge module is used in battery-powered smart car, toy cars and robots. It can manage a supply voltage 2V ~ 10V and can drive two DC motors, which is what has been put on my robot.

Test 2—The next test was to make sure that the car stops and turns 90 degrees at a given distance from a wall. The test was run multiple times and it worked.

Test 3 - The next test that was developed was for it to go forward to an object, as above, when it came to an object turn right 90 degrees and then run on until it detected an object and then stop. This proved successful.

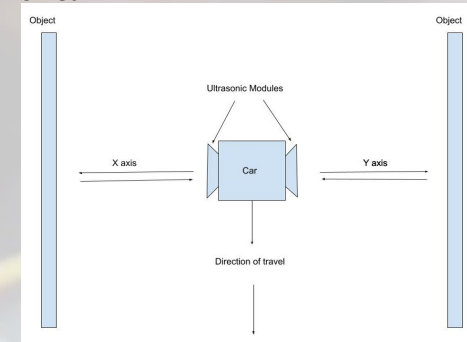
Two more ultrasound modules were then mounted on the car one on the left and one on the right.

Using these two extra modules with the forward facing module it was possible to make the car self-steer, it will avoid objects and be steering away to its left or right. The test was run multiple times and it worked.

IF $0.5 < \frac{x}{y} < 1.5$ go straight

IF $\frac{x}{y} > 1.5$ turn right

IF $\frac{x}{y} < 0.5$ turn left



After the obstacle obvodance robot was working I tried to develop a PCB bored at home, unfortunately this was only somewhat successful and it was now to a good enough standard to use for the project.

