Autonomous Vehicle

(Joshua Burkhart && Greg Braman)

Summary

The goal of this project was to create an autonomous vehicle that could navigate itself to predetermined GPS way-points by using several key pieces of hardware:

•An Arduino Platform

•A digital compass

•A GPS receiver

•Small electric motors

In addition to these pieces of hardware, an optoelectronic device was added to the device in order to provide collision avoidance.

Implementation

•The vehicle was built on a tracked chassis with one DC motor controlling each track.

•Each motor has the ability to turn both forward and backward.

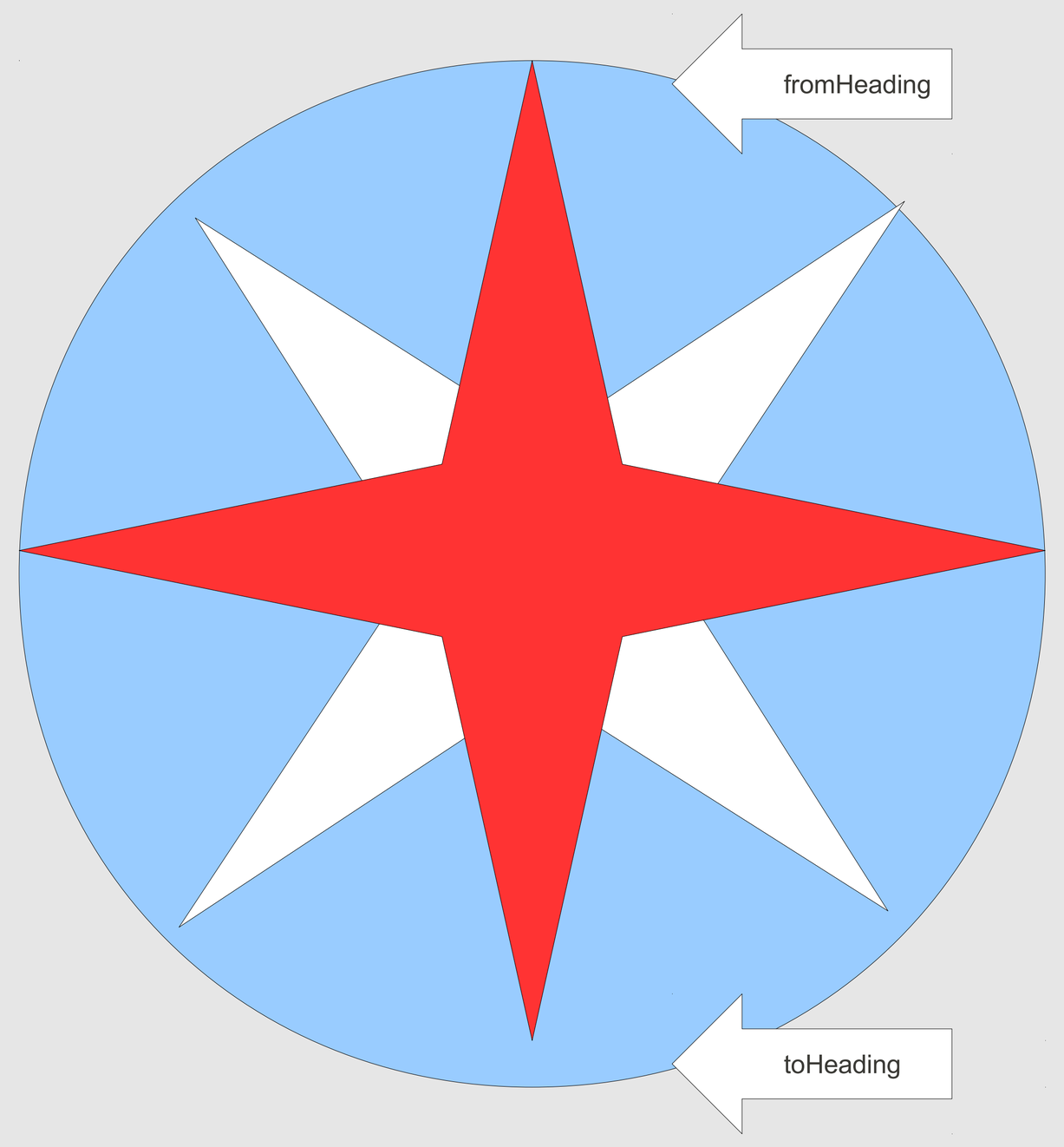
•The motors are wired to a 'motor shield' that acts as an interface between the motors and the Arduino.

•A digital compass provides directional readings to the Arduino through digital communication.

•A 'GPS shield' provides NMEA coordinates to the Arduino through serial communication.

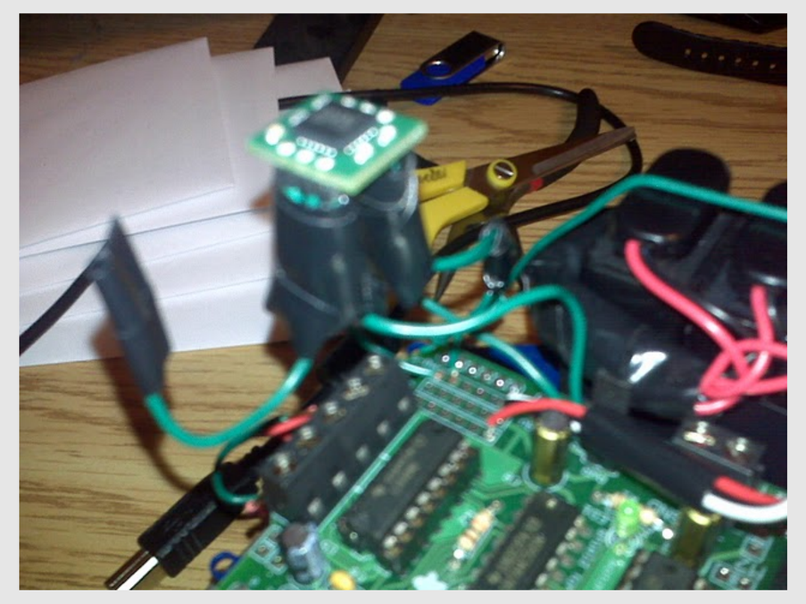
•An optoelectronic device provides distance readings through voltage readings. (voltage indirectly maps to distance)

Digital Compass

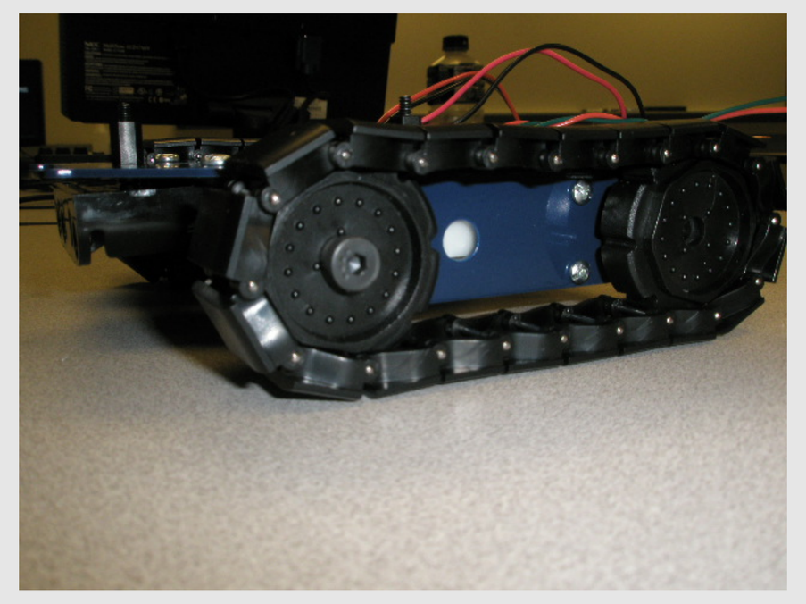


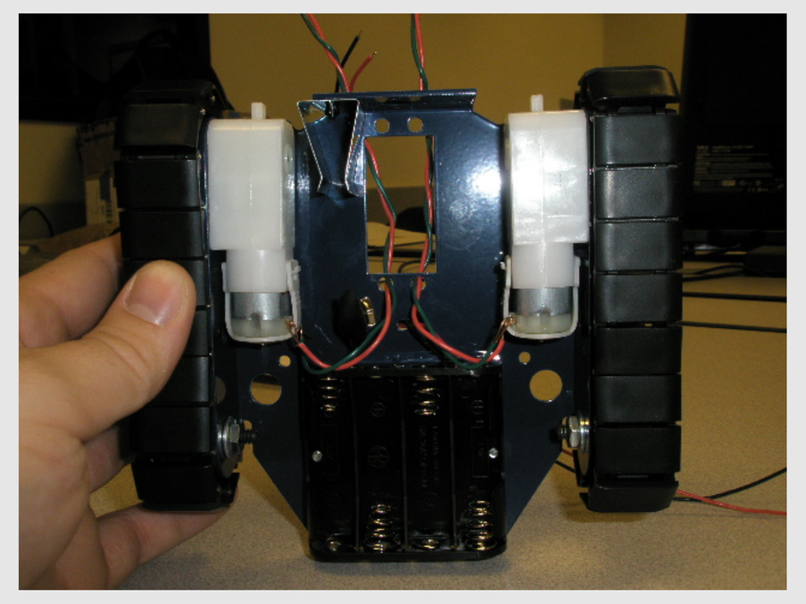
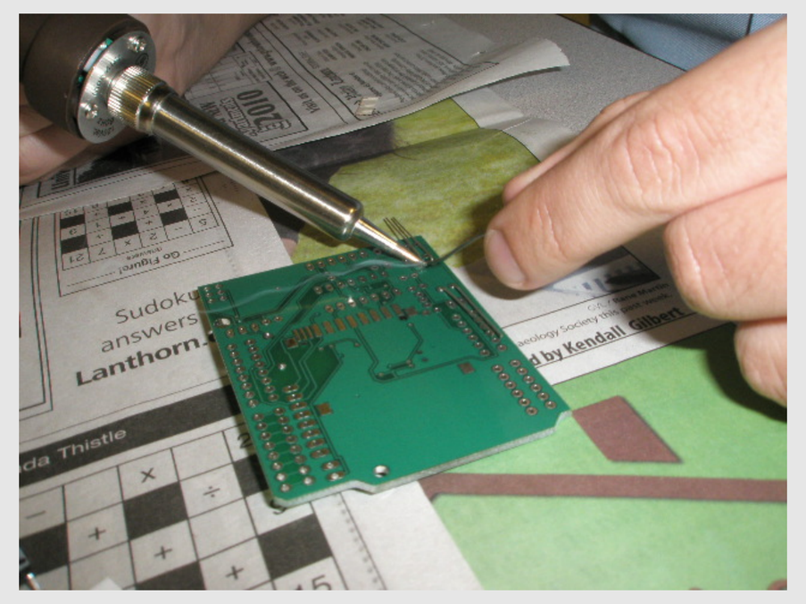
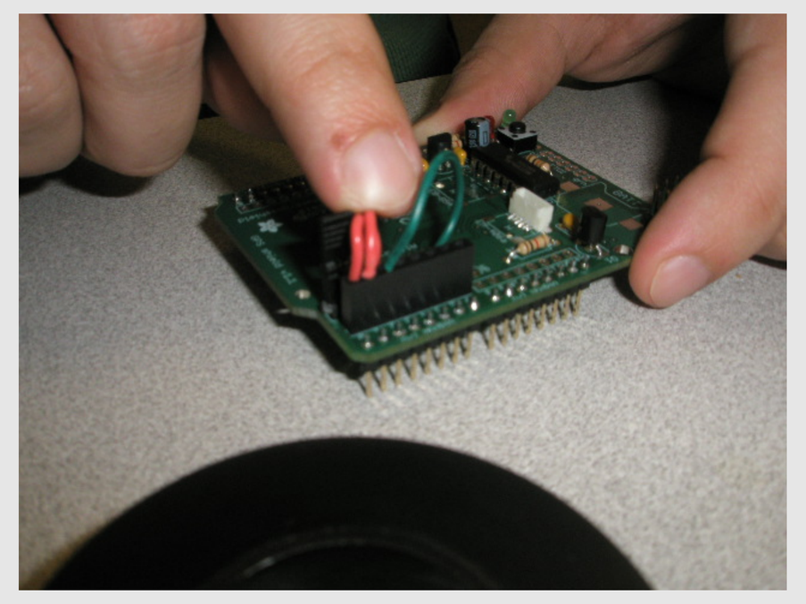
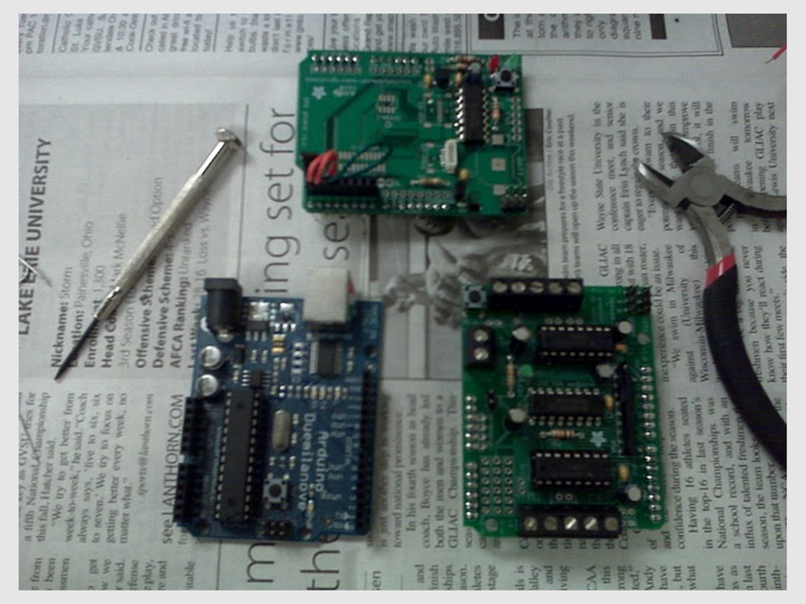
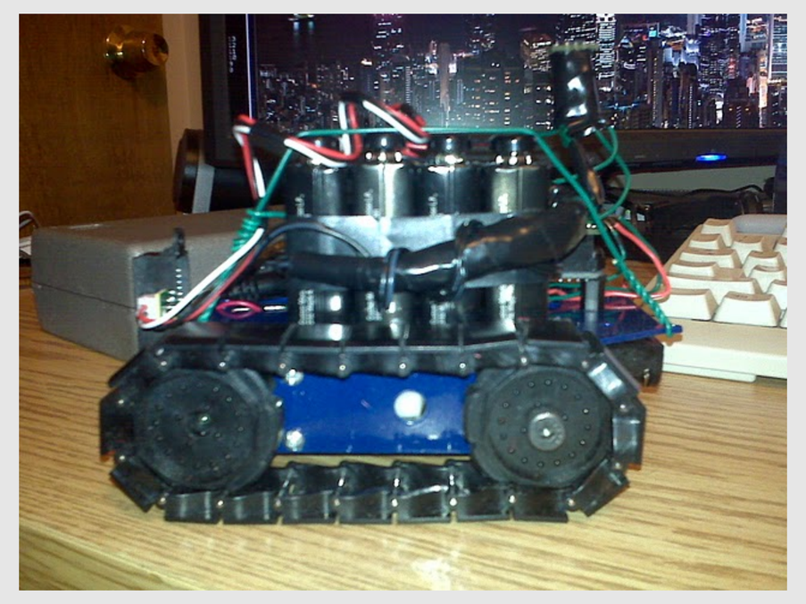
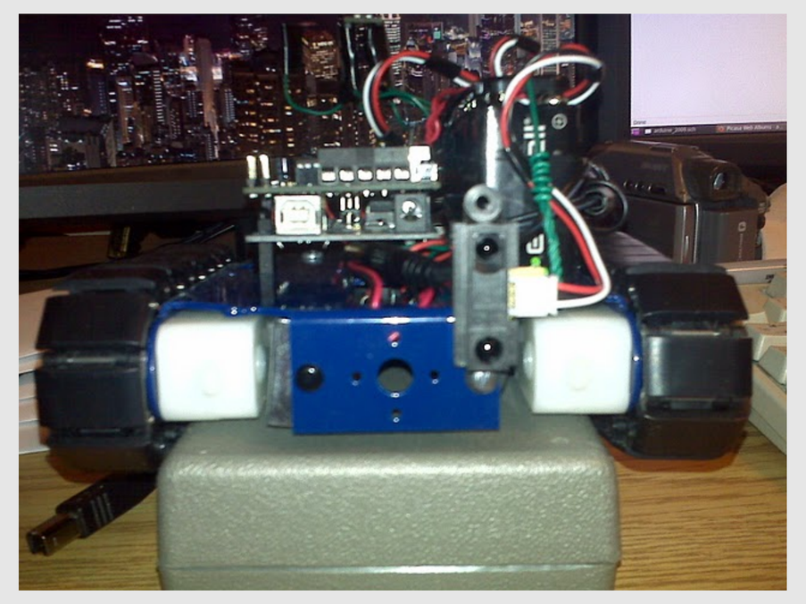
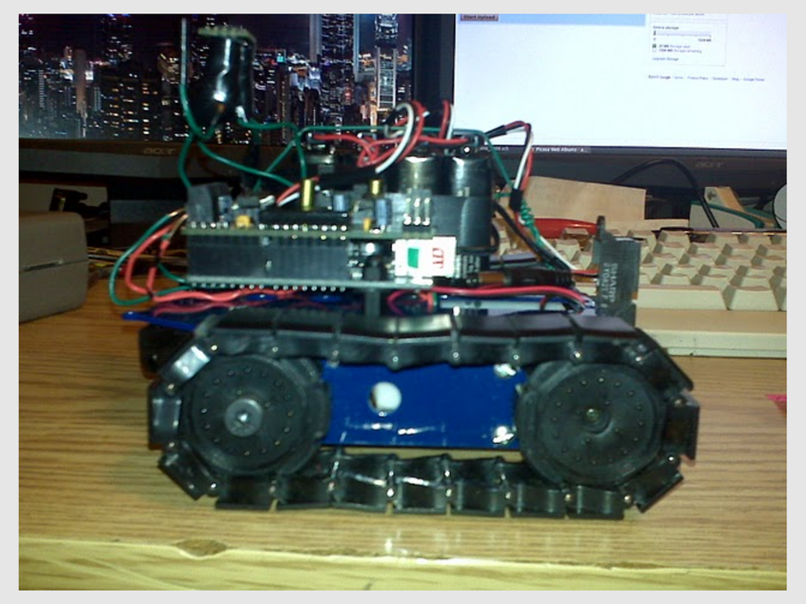

```
/*
This function replaces the under-powered '%'
function
@return - the result of (x mod m)
*/
int mod(int x, int m) {
   return (x%m + m)%m;
}//end mod function

…

int   left   = mod((toHeading - fromHeading),360),
        right = mod((fromHeading – toHeading),360);
…

 if(right > left){//if fromHeading is left of toHeading
      //turn right in small increment
      mturn(RIGHT, (left * abs(15 - numTurns)));
 }//end if
 else{//fromHeading is right of toHeading
      //turn left in small increment
      mturn(LEFT, (right * abs(15 - numTurns)));
 }//end else
```

Is it faster to turn right or turn left? This seems an obvious question for you and I, but a problem arises when trying to communicate this to an autonomous rover. The digital compass is capable of returning numerical heading information (0 to 360 degrees), making West 90 degrees from North, but North -90 degrees from East. To solve the problem we had to write our own modulus function, replacing the typical '%.'



Photos



Select Source Code

(full source at "http://www.github.com/joshuagburkhart/Autonomous-Vehicle-GVSU")

Development Environment

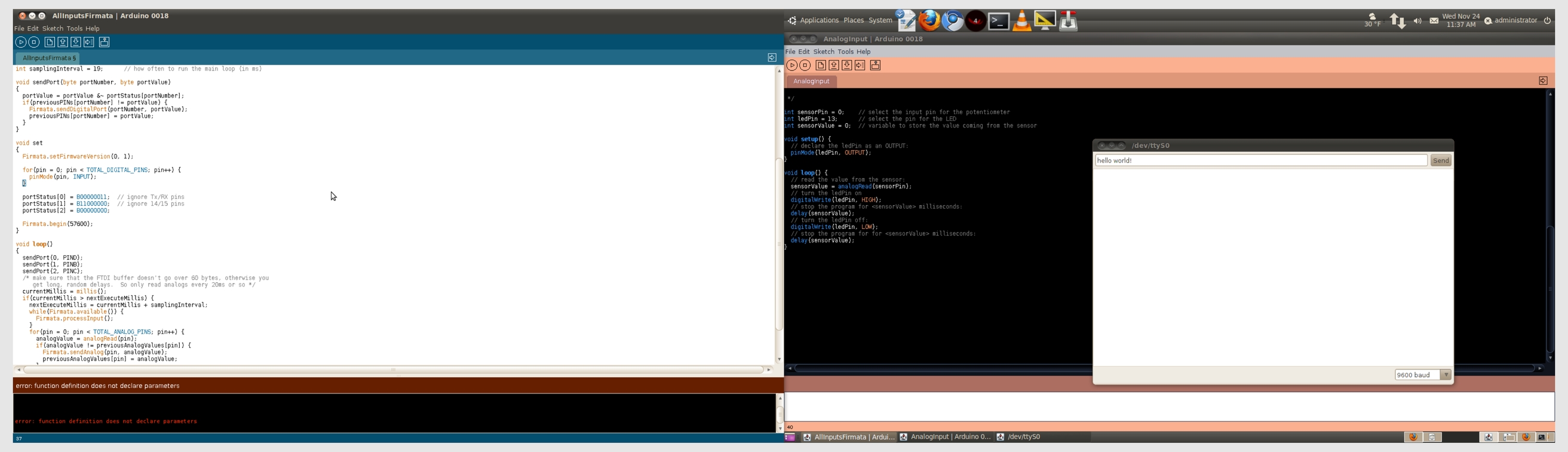
The arduino microcontroller uses the 'processing' language and has its own IDE. Features include:

›serial monitor

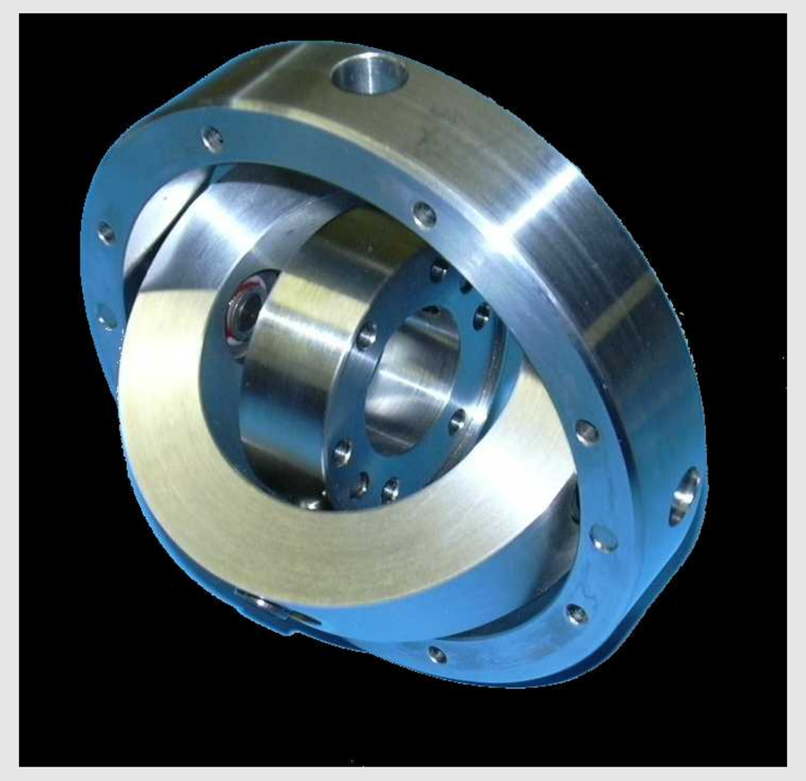
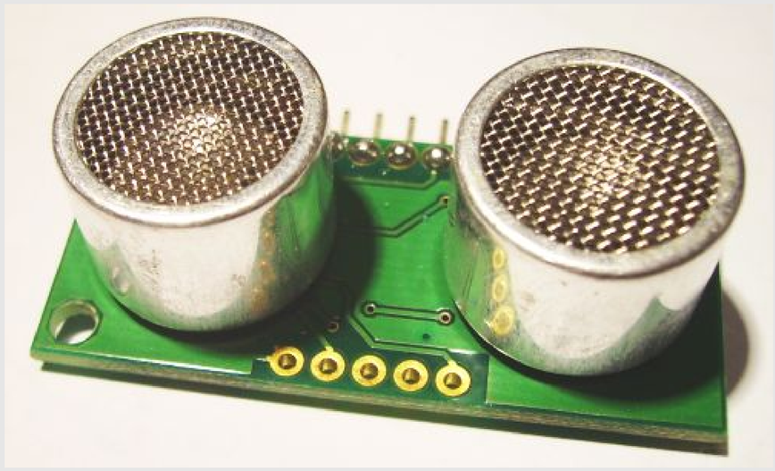
›example programs

›code verification

›hassle-free code pushing to the arduino



Download free at "http://www.arduino.cc/en/Main/software"


Wish List: Parts We Couldn't Afford

›Gimbal – would have helped the compass correctly align to terrain grade, resulting in a more accurate sense of direction

›Ultrasonic Range Finder – would have assisted in collision avoidance due to increased precision of distance measurement

›Large Chassis – would have allowed us more ground clearance, giving us more opportunities to perform outdoor testing