

“Octo-Robot”

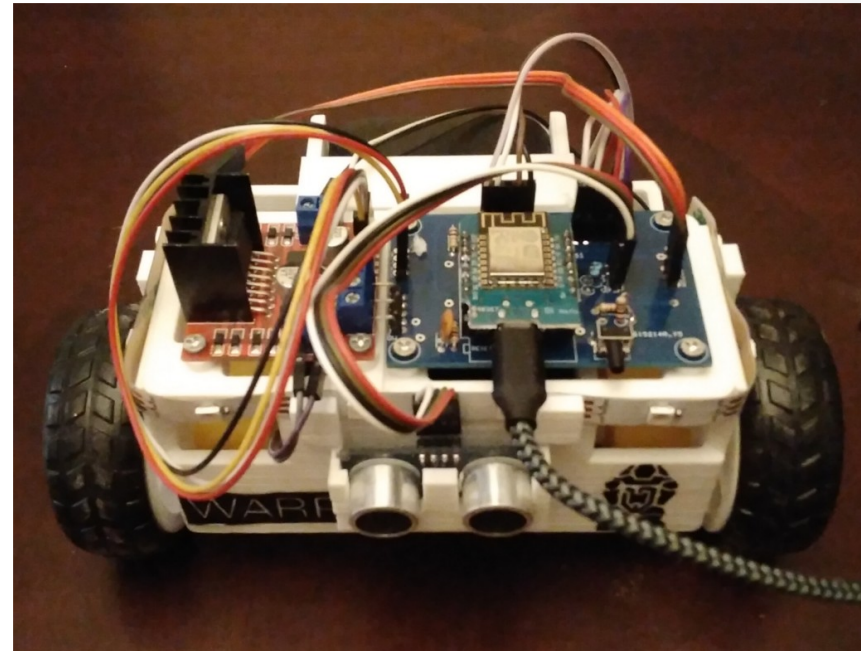
Presentation Outline

- Intro – what were we trying to accomplish
- Robot Hardware & “Firmware”
- Low Level Robot Command Speed Run
- First Robotics Java Emulation Code
- First Robotics Example Code

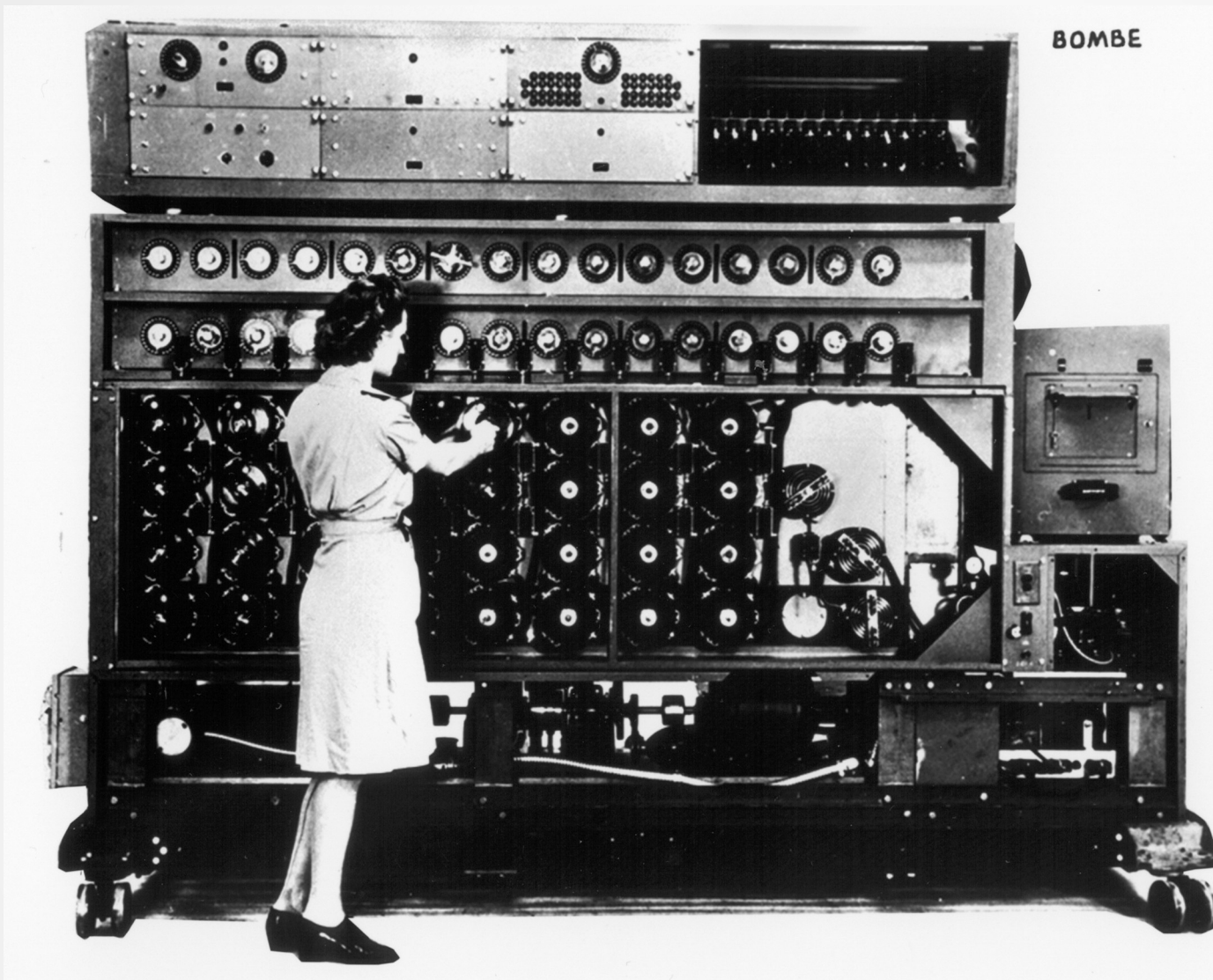
Goals

What is it

- Inexpensive Trainer for First Robotics Programming
- Hardware Features
 - Two motors
 - Two encoders
 - Sonar Range Finder
 - Status Lights
- “Driven” from a PC
 - Like a remote controlled car,
 - But student robot code is doing the driving



Goals



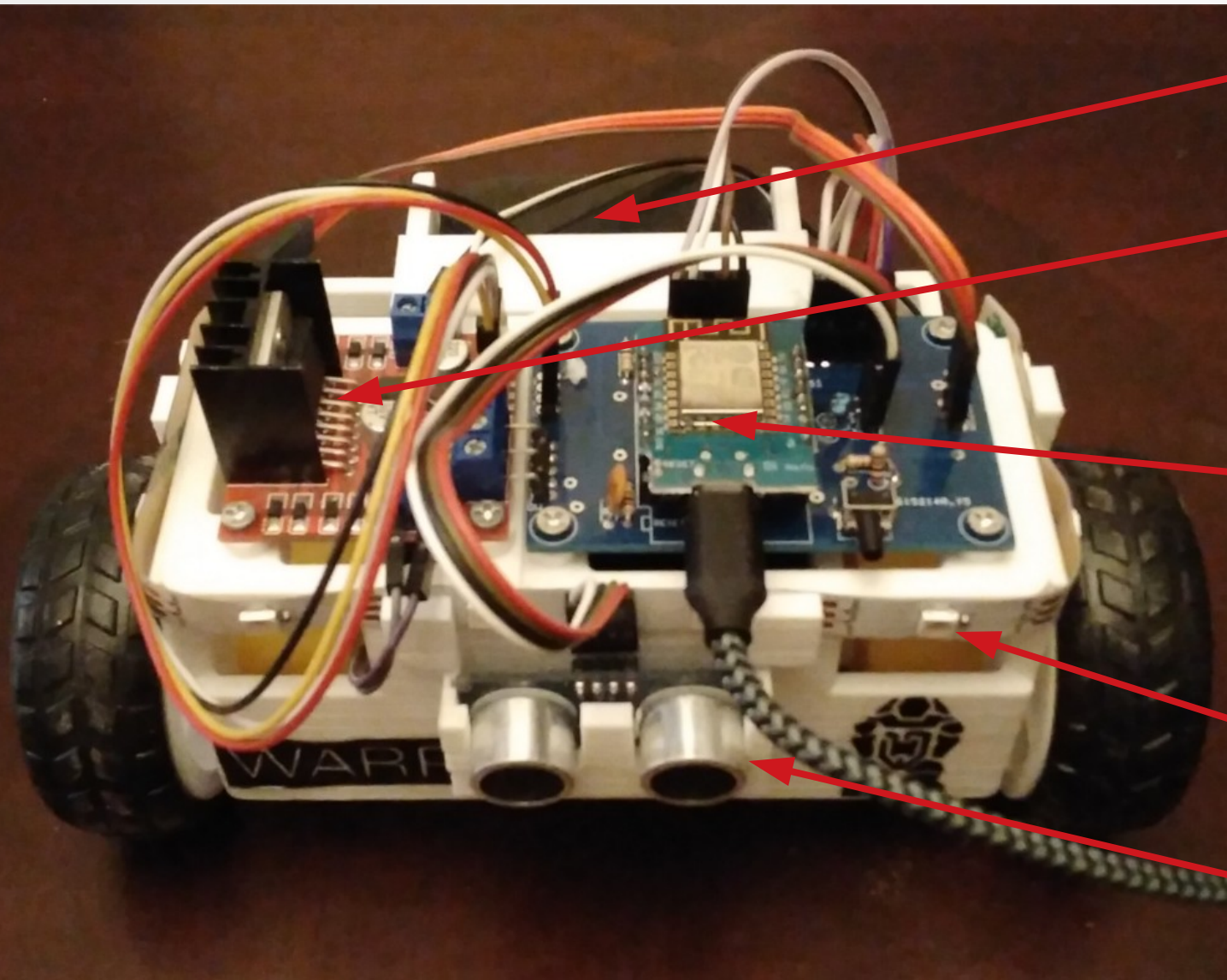
“Make it easy to start First Robotics programming”

Goals

- Inexpensive and friendly (parts cost <\$50)
- Programmed like a competition robot
 - Visual Studio Code Java Environment
 - First Robotics Smart Dash Board
 - First Robotics like hardware interfaces
- Enough hardware for basic Robot tasks
 - Encoders for PID Controllers + Sonar Range Finder

Robot Hardware & “Firmware”

Robot Hardware



Battery Pack

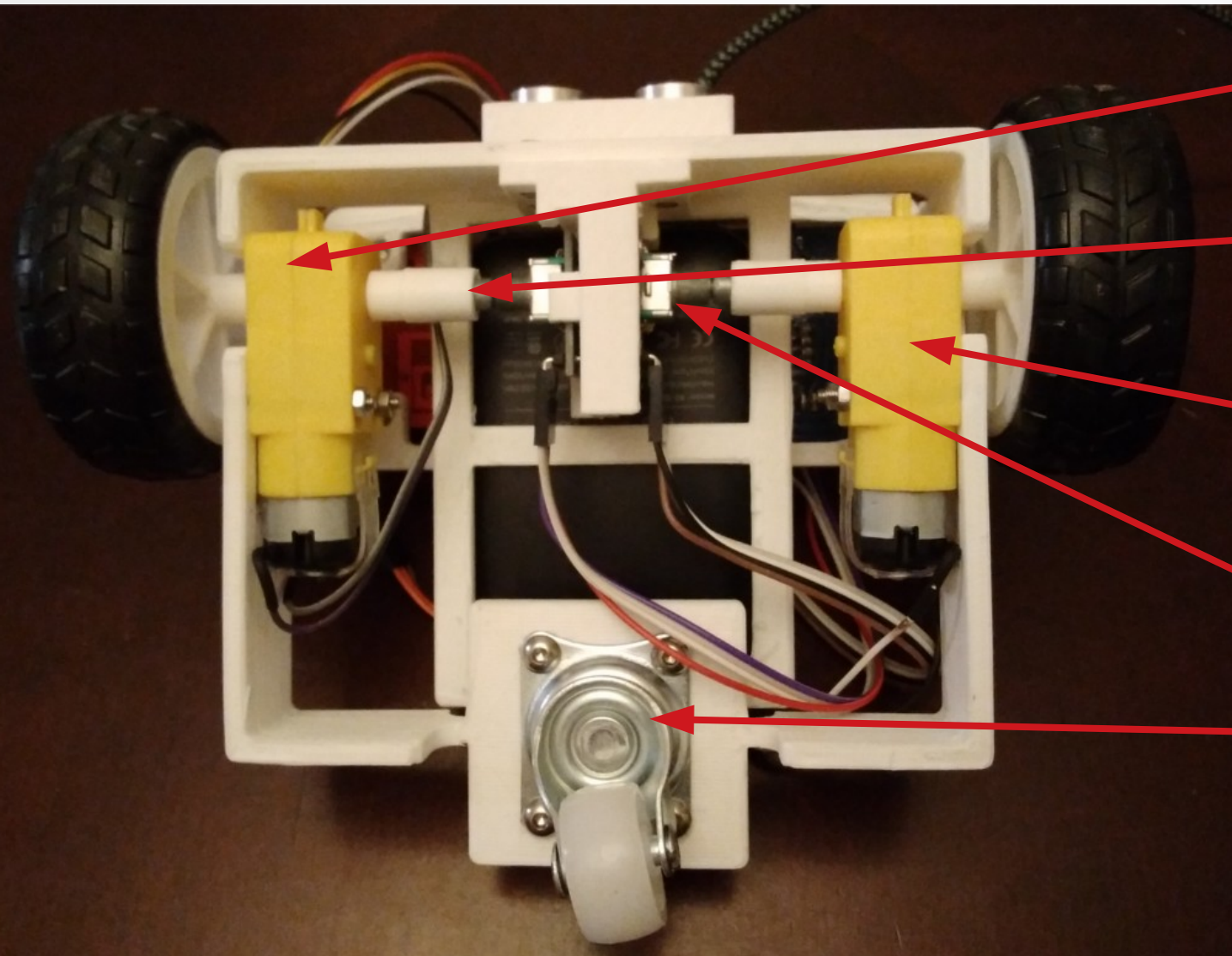
Motor
Controller

I.O.T.
Microcontroller

Status Lights

Sonic Range
Finder

Robot Hardware



Right Motor

Right Encoder

Left Motor

Left Encoder

Rear Wheel

How it Works



The Robot Creates a WiFi Access Point

- Robots have unique SSIDs. Password is graciousp

How it Works

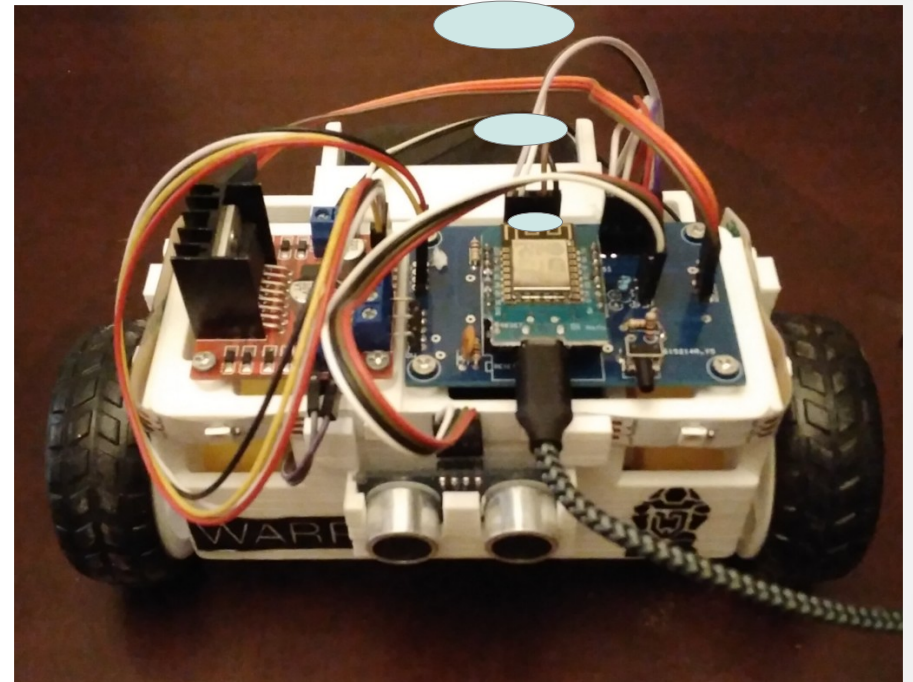


Computer Connects to WiFi access point

- The computer & robot form a private “intranet”

How it Works

Listening to 192.168.4.1
Port 4999



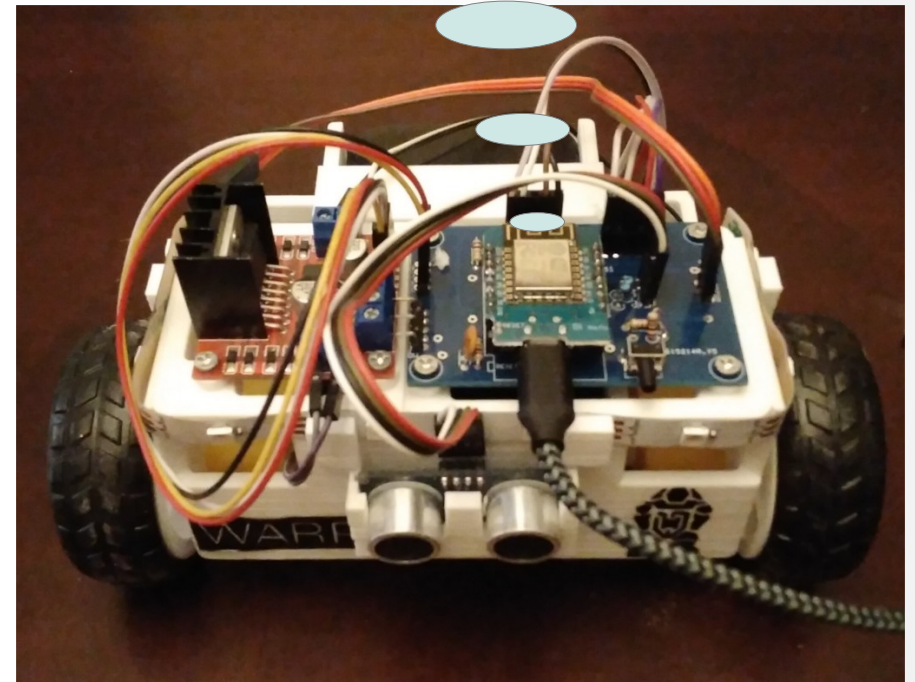
The Robot Listens to a TCP/IP Socket

- Web Servers work in a similar way

How it Works

Connect to 192.168.4.1
Port 4999

Listening to 192.168.4.1
Port 4999



The Java Code on the laptop connects to the robot

- Like a browser connecting to a web server

The Physical Robot is Pretty Basic

- First Robotics Competition Robot
 - Robo Rio is the brains of the robot
 - Robo Rio talks to devices like motors through a bus
 - Libraries for talking to the devices are provided
- Trainer “Oct-Robot”
 - Your PC is the true brains of the robot
 - PC talks to devices like motors through the WIFI
 - Libraries for talking to the devices are provided

Low Level Robot Command Speed Run

Low Level Commands - Connecting

```
andrew@miles: ~  
File Edit View Search Terminal Help  
(base) andrew@miles:~$ telnet 192.168.4.1 4999  
Trying 192.168.4.1...  
Connected to 192.168.4.1.  
Escape character is '^]'.  
# Urban Octo Robot is ready for commands  
█
```

Command that connects to robot

Robot's Address and port

Robot saying "I'm listening & ready"

Low Level Commands - Motor

```
andrew@miles: ~  
File Edit View Search Terminal Help  
Trying 192.168.4.1...  
Connected to 192.168.4.1.  
Escape character is '^]'.  
# Urban Octo Robot is ready for commands  
motorl=100  
# Got: motorl=100  
100  
█
```

Tell Left Motor to go at 100%. This is something I typed in by hand

Robot saying "I got the command"

Low Level Commands - Motor

```
andrew@miles: ~  
File Edit View Search Terminal Help  
# Urban Octo Robot is ready for commands  
motorl=100  
# Got: motorl=100  
100  
motorrr=100  
# Got: motorrr=100  
100  
█
```

Tell Right Motor to go at 100%.

Robot saying "I got the command"

Low Level Commands - Motor

```
andrew@miles: ~  
File Edit View Search Terminal Help  
100  
motorr=100  
# Got: motorr=100  
100  
motorr=-100  
# Got: motorr=-100  
-100  
█
```

Tell Right Motor to go at -100%.

“Go counter clockwise instead of clockwise”

Low Level Commands - Encoder

```
andrew@miles: ~  
File Edit View Search Terminal Help  
100  
motorr=-100  
# Got: motorr=-100  
-100  
encoderl  
# Got: encoderl  
encoderl 42542 94141
```

Read the Left Encoder

Left Encoder Position

Left Encoder Rotation Speed
(94141 = ~1.44 rotations / sec)

Low Level Commands - Encoder

```
andrew@miles: ~  
File Edit View Search Terminal Help  
-100  
encoderl  
# Got: encoderl  
encoderl 42542 94141  
encoderl  
# Got: encoderl  
encoderl 45899 97260
```

Encoder Position
Changes while
the wheel runs at
100%

Encoder Speed is
about the same

$94141 = 1.44 \text{ rot/s}$

$97260 = 1.48 \text{ rot/s}$

Raw Commands - "motora"

```
andrew@miles: ~  
File Edit View Search Terminal Help  
encoderl 42542 94141  
encoderl  
# Got: encoderl  
encoderl 45899 97260  
motora=0  
# Got: motora=0  
0  
█
```

"motora" sets all motors. Setting all motors to 0 stops the robot

Low Level Commands - “encoderr”

```
andrew@miles: ~  
File Edit View Search Terminal Help  
0  
encoderr  
# Got: encoderr  
encoderr -1575 0  
encoderr  
# Got: encoderr  
encoderr -1575 0
```

“encoderr” gets the right encoder

If the motors are off, position doesn't change

And rotation speed is 0

L.L. Command - Spam Sensor Data

```
andrew@miles: ~  
File Edit View Search Terminal Help  
0  
encoderr  
# Got: encoderr  
encoderr -1575 0  
encoderr  
# Got: encoderr  
encoderr -1575 0  
datasend=1
```

datasend=1 tells the robot to send encoder and sonar range finder data every 1/10th of a second

datasend=0 turns this off.

L.L. Command - Spam Sensor Data

```
andrew@miles: ~
File Edit View Search Terminal Help
RNG 688
ENL 49204 0
ENR -1575 0
RNG 680
ENL 49204 0
ENR -1575 0
RNG 689
```

Left Encoder
Position

Left Encoder
Rotation Speed

Right Encoder
Position

Right Encoder
Rotation Speed

Sonar Sensor
Distance in mm

First Robotics Java Emulation Code

TODO

- TODO
 - TODO

First Robotics Example Code

TODO

- TODO
 - TODO