IPhone Controlled Robotic Project

Matthew Fisher **Vanessa Geraldi**

The iPhone
Features and Technology

- Internet-able mp3 player, camera, and smartphone
- Less than 140g (5oz)
- Fast & reliable performance
- User-friendly graphical interface

The iPhone
Features and Technology

- Wi-Fi Capability
- 3G Network Capable
- Internal 3-axis accelerometer
- GPS

User Datagram Protocol (UDP)

Disadvantages

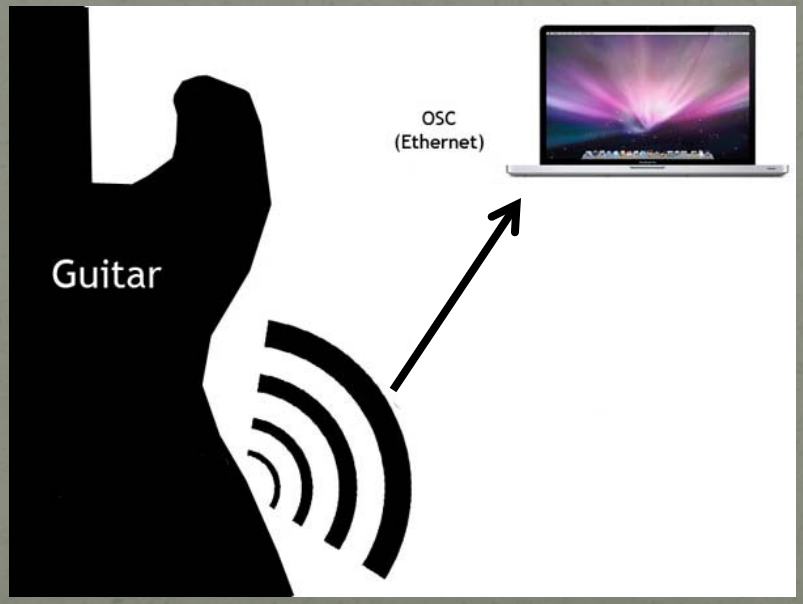
- Unreliable
  - Doesn't check if transmitted data was received
- Does not check for errors

Advantages

- Connectionless protocol
  - Leads to it being faster

Open Sound Control (OSC)

- Versatile, real-time message-based protocol
- Originally intended for the music industry

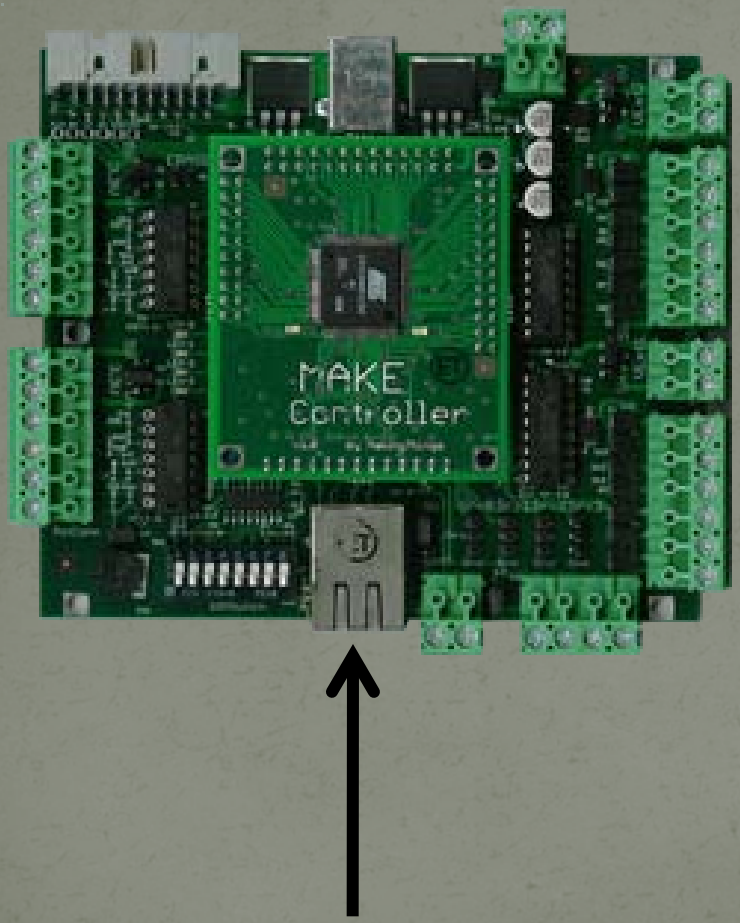


Open Sound Control (OSC)

- Communication between iPhone and wireless router.

- Software used was iOSC ( )

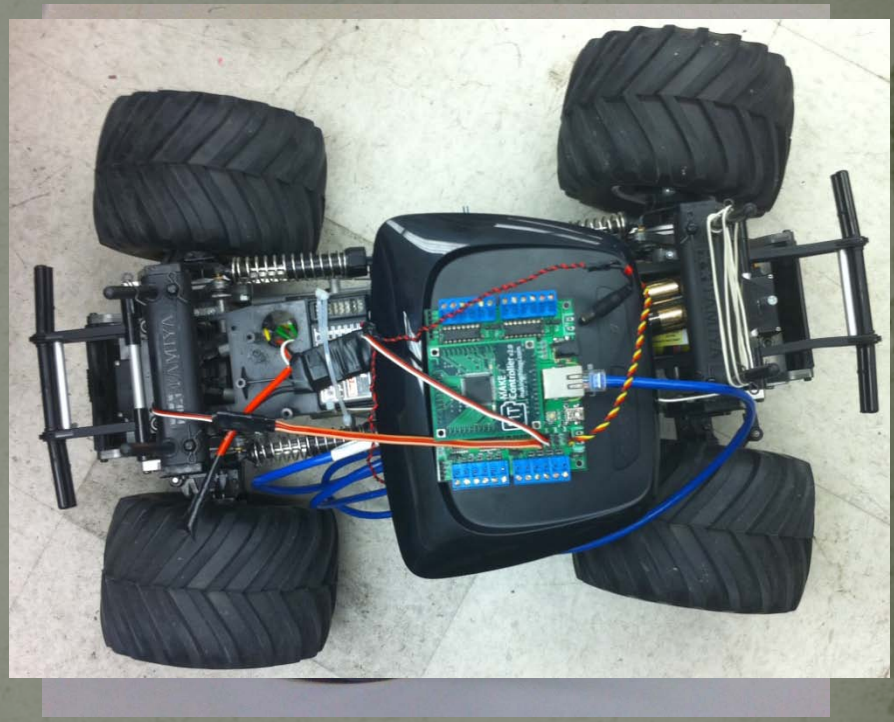
The MAKE Controller

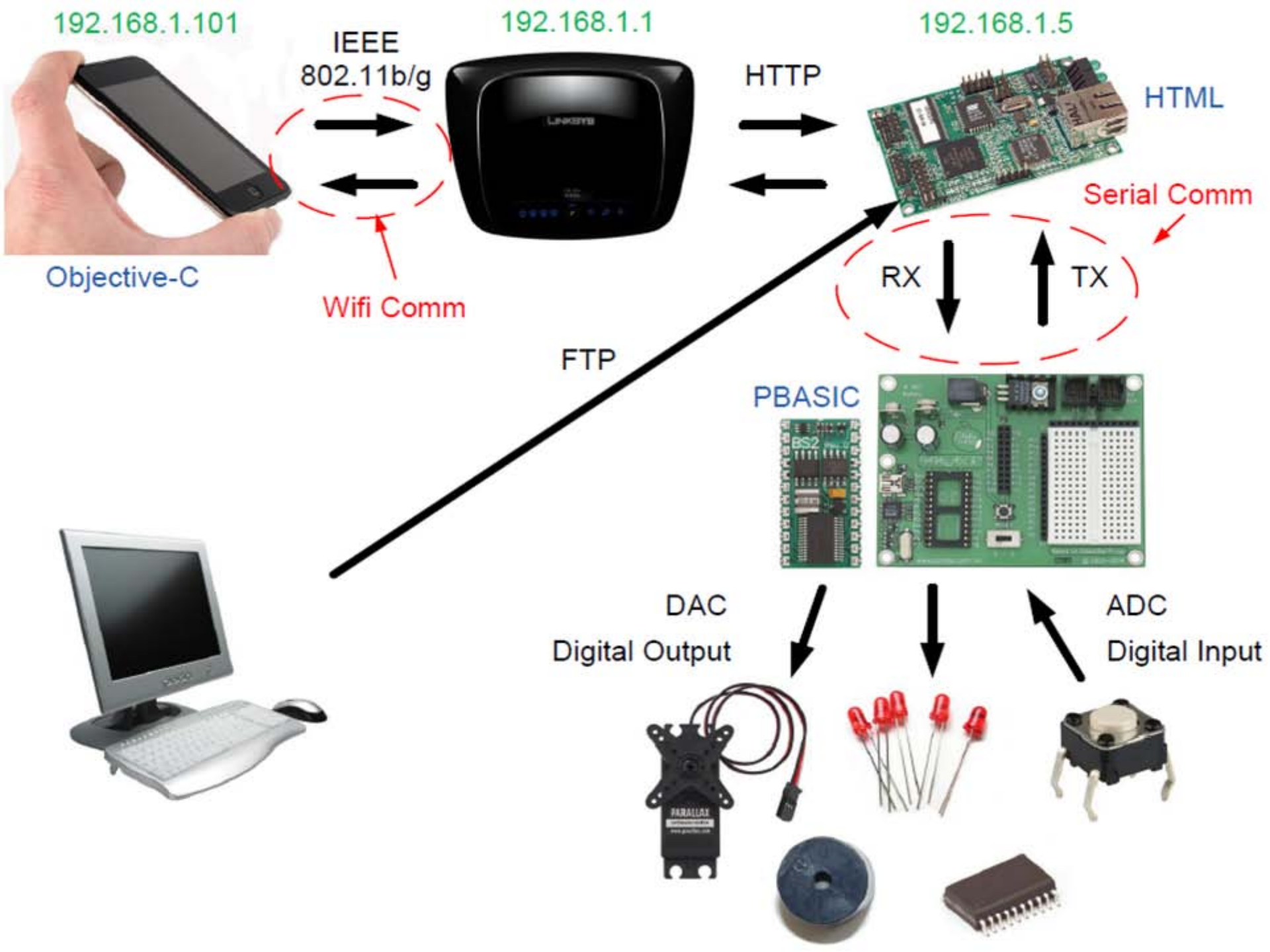


- Built-in Ethernet
- Easy to use C-based program
- Hardware OSC implementation

What's Been Done

- iBoe-bot
- Smart House
- RC Truck

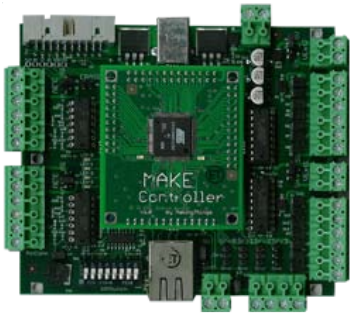



192.168.1.101
IEEE
802.11b/g
192.168.1.1
HTTP
192.168.1.5
HTML
Objective-C
Wifi Comm
Serial Comm
RX
TX
FTP
PBASIC
BS2
DAC
Digital Output
ADC
Digital Input
PARALLAX

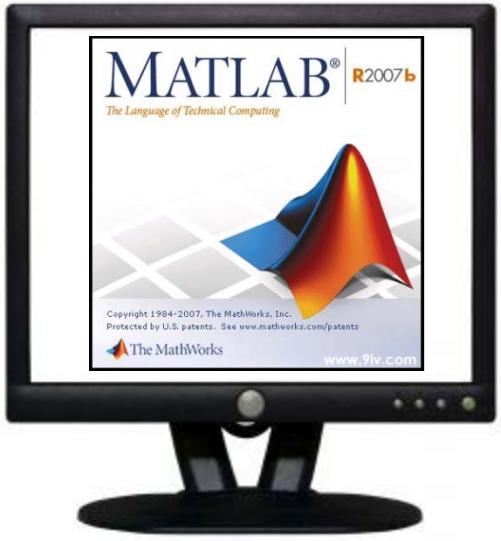
Project Summary

Wireless Router

MAKE controller

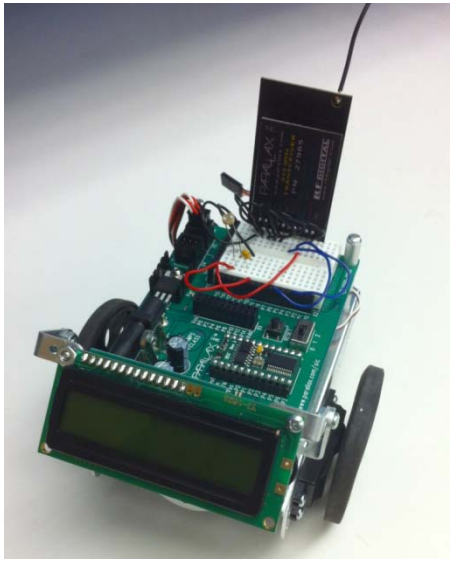


iPhone



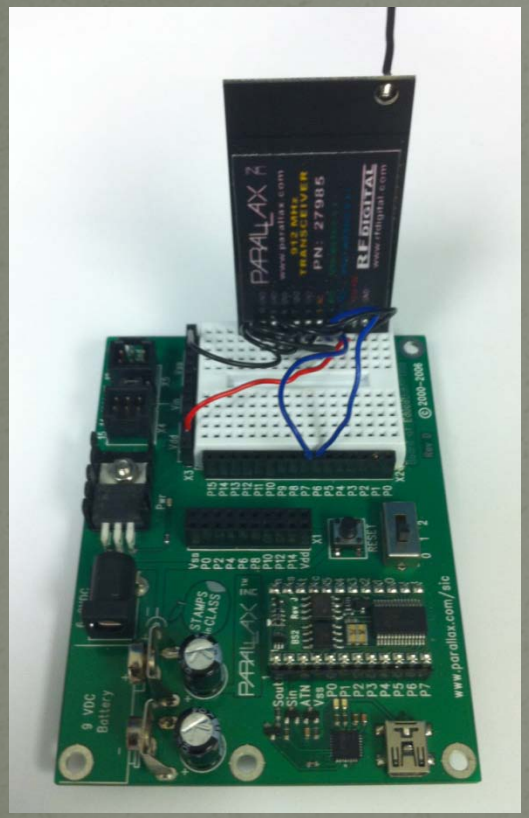
Messenger BS2
(Transceiver)

Boe-Bot BS2
(Transceiver)

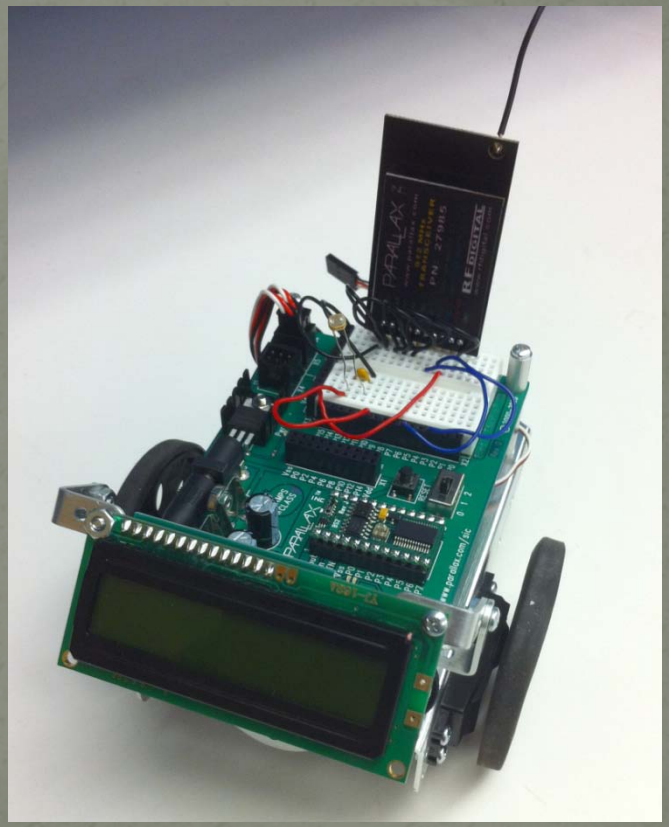


BASIC Stamp 2 Communication

Messenger BS2



Boe-Bot BS2

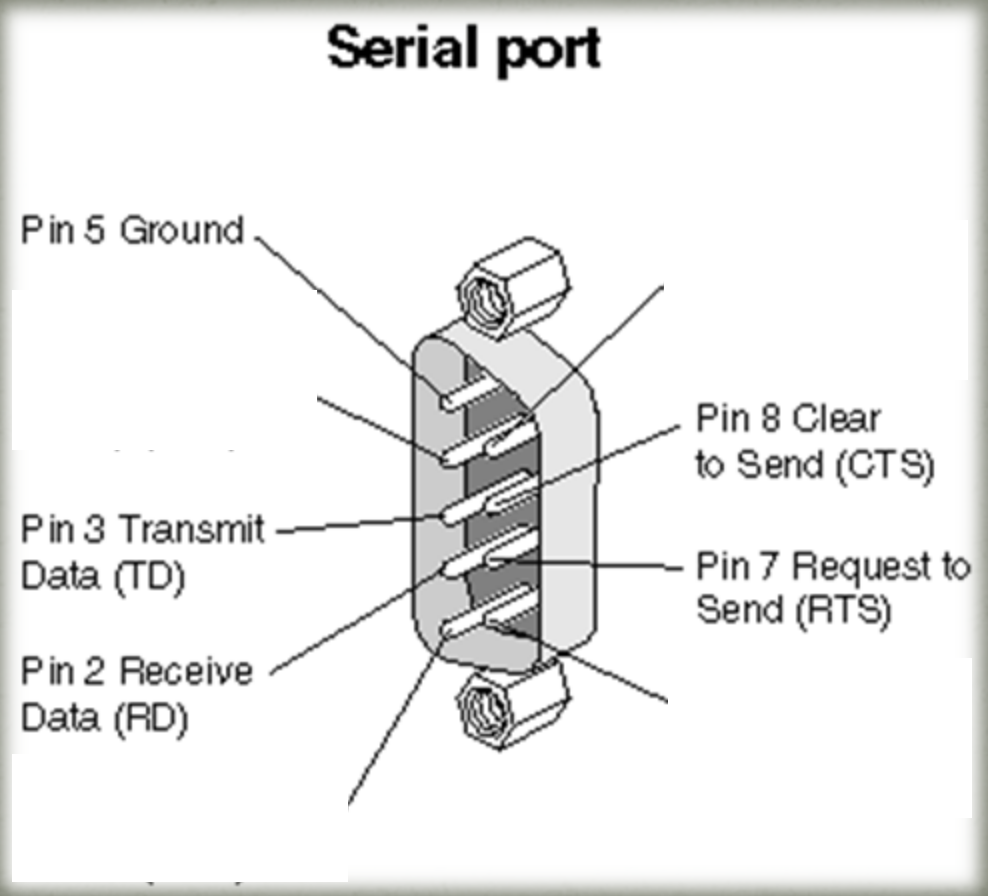


Serial Communication

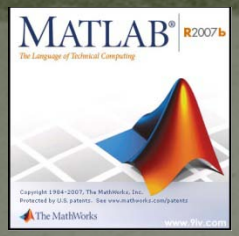
- Serial ports, also called **communication (COM) ports**
- Basic physical connection to a computer
- Well over 20 years
- Uses flow control
- Newer systems favor USB connections

Serial Communication

- Serial devices use different pins to receive and transmit data

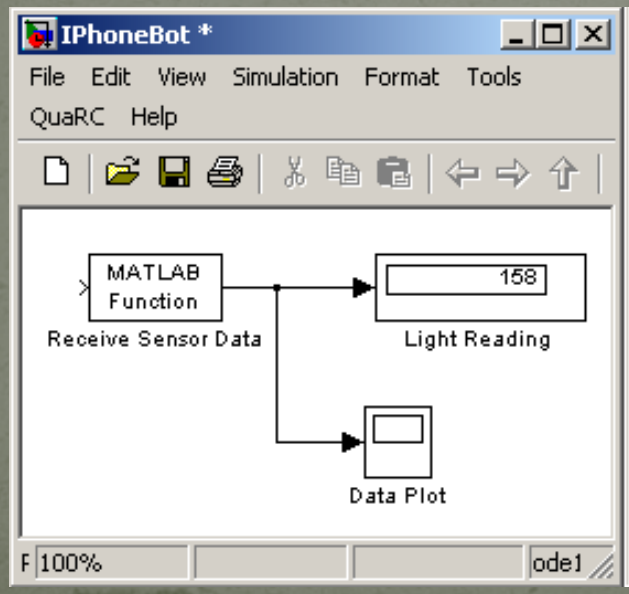


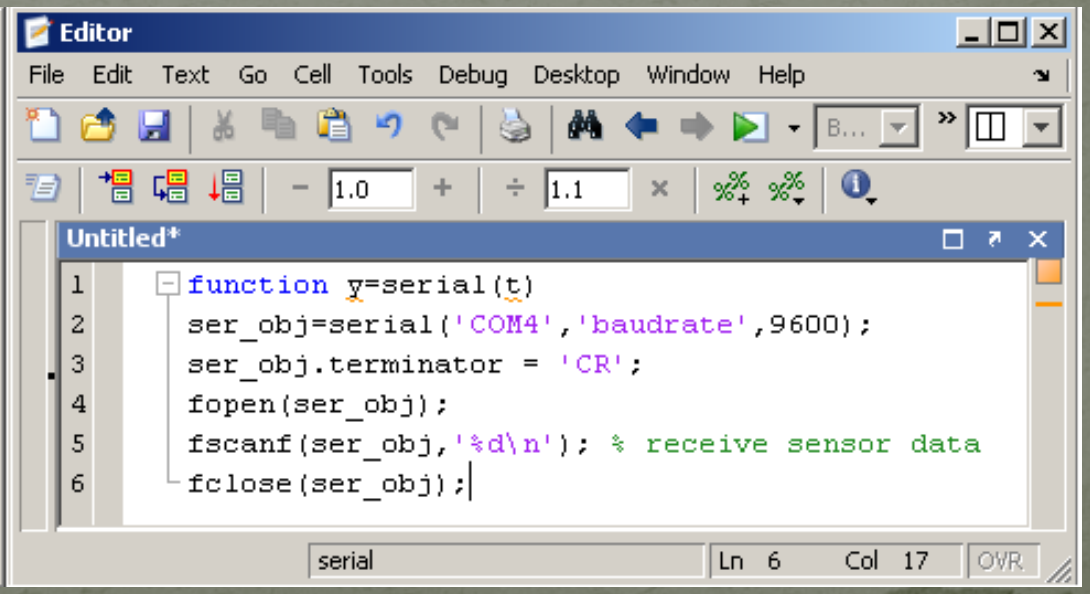
- Multiple pins allow for messages to be sent in both directions simultaneously

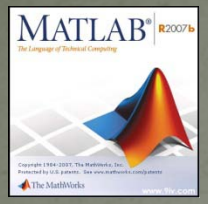


MATLAB

- Powerful, widely used engineering software
- Data Acquisition, Processing, Computation, and Control Applications
- Receives sensory data from the messenger BS2
- Displays / plots data and processes for future use







MATLAB

MATLAB 7.5.0 (R2007b)

File Edit Debug Desktop Window Help

Current Directory: C:\Documents and Settings\User\My Documents\MATLAB

Shortcuts How to Add What's New

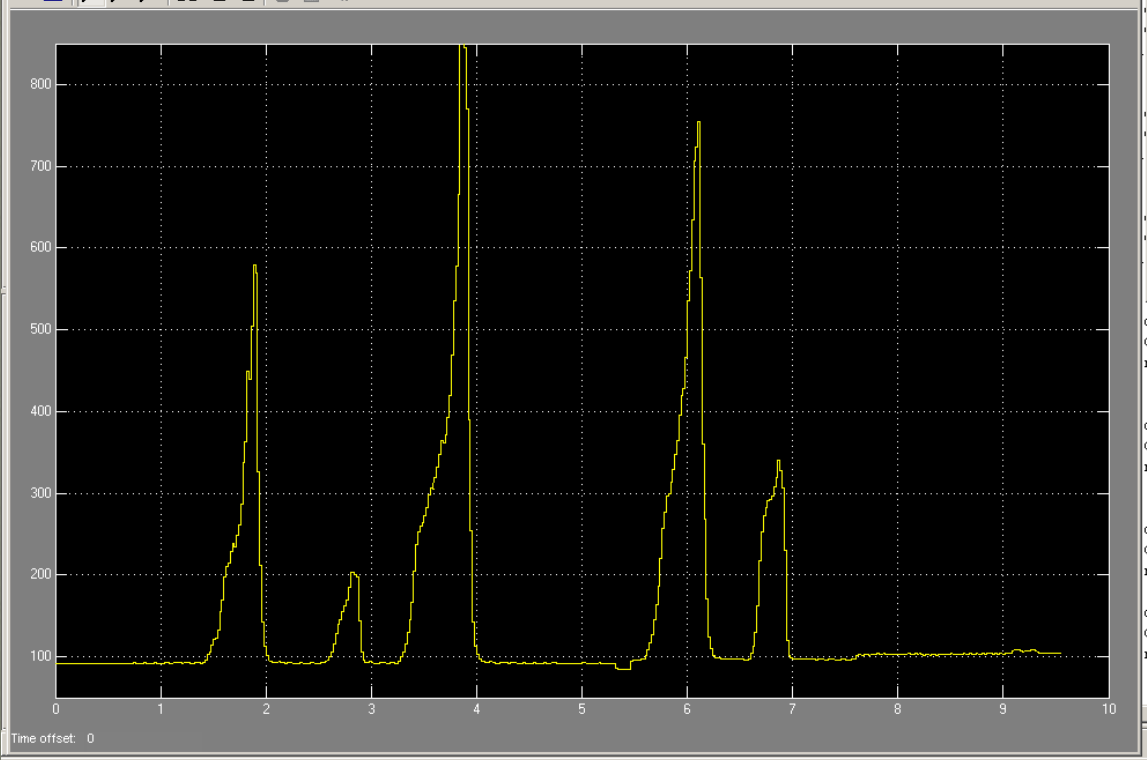
Workspace

Name	Value
ser_obj	<1x1 serial>

Command Window

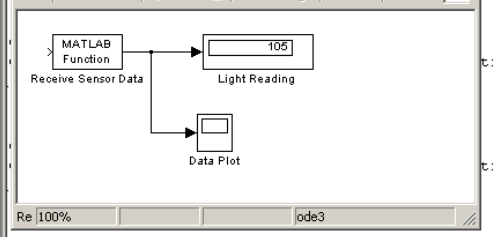
```
Warning: Input port 1 of 'IPhoneBot/MATLAB Fcn' is not connected.
Warning: A timeout occurred before the Terminator was reached.
Warning: The model 'IPhoneBot' does not have continuous states, hence using the solver 'FixedStepDiscrete' instead of solver 'ode1'. You can
disable this diagnostic by explicitly specifying a discrete solver in the solver tab of the Configuration Parameters dialog, or setting 'Automatic
                                                                                    Parameters dialog.
```

Data Plot



IPhoneBot *

File Edit View Simulation Format Tools QuaRC Help



Re 100% ode3

```
dStepDiscrete' instead of solver 'ode3'. You can
Configuration Parameters dialog, or setting
nfiguration Parameters dialog.

dStepDiscrete' instead of solver 'ode3'. You can
Configuration Parameters dialog, or setting
nfiguration Parameters dialog.

dStepDiscrete' instead of solver 'ode3'. You can
Configuration Parameters dialog, or setting
nfiguration Parameters dialog.

dStepDiscrete' instead of solver 'ode3'. You can
Configuration Parameters dialog, or setting
nfiguration Parameters dialog.
```

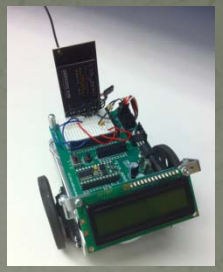
Start | BASIC Stamp Editor | MATLAB 7.5.0 (R2007b) | IPhoneBot * | MatlabSimulinkRobot.bm... | Data Plot | 6:26 PM

Messenger BS2 Program

```
Main:
  SERIN SI\FC, baud, timeout, SendRF, [cmd] ' receive one byte
GOTO SendRF
```

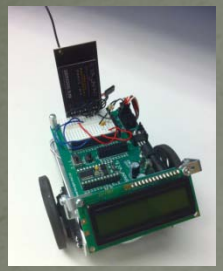
```
SendRF:
  PULSOUT txpin, rfpulse                'Sync pulse for the receiver
  SEROUT txpin, baud, ["!", cmd]
  PAUSE 10
  IF (cmd = 0)THEN
    SERIN rxpin, baud, 100, Main, [WAIT("!"), light]
    SEROUT 16, 84, [DEC light, CR]
  ENDIF
GOTO Main
```

Boe-Bot BS2 Program



```
Main:
GOSUB ReadRF
GOTO Decision
'GOSUB Display

ReadRF:
SERIN rxpin, baud, [WAIT("!"), cmd]
RETURN

Decision:
DEBUG ? cmd
IF (cmd = 1) THEN
GOTO Forward
ELSEIF (cmd = 2) THEN
GOTO Rotate1
ELSEIF (cmd = 3) THEN
GOTO Rotate2
ELSEIF (cmd = 4) THEN
GOTO Backward
ELSE
GOTO NoMove
ENDIF
GOTO Main

NoMove:
HIGH sensor
PAUSE 10
RCTIME sensor,1,light 'measure the light intensity on the sensor
'DEBUG ? light
PULSOUT txpin, 1200 'Sync pulse for the receiver
SEROUT txpin, baud, [ "!", light]
PAUSE 10
GOTO Main Forward:
PULSOUT 13, 850
PULSOUT 12, 650
PAUSE 15
GOTO Main
```

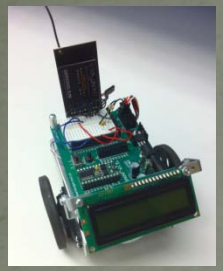
```
Display:
SEROUT LCDPin, baud, [22, 12]
PAUSE 5
SEROUT LCDPin, baud, ["cmd=", DEC cmd]
SEROUT LCDPin, baud, [128]
RETURN

Rotate1:
PULSOUT 13, 650
PULSOUT 12, 650
PAUSE 15
GOTO Main

Rotate2:
PULSOUT 13, 850
PULSOUT 12, 850
PAUSE 15
GOTO Main

Backward:
PULSOUT 13, 650
PULSOUT 12, 850
PAUSE 15
GOTO Main
```



Boe-Bot BS2 Program

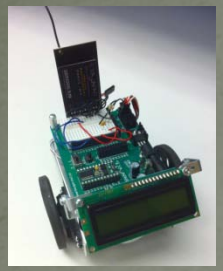
```
Main:
GOSUB ReadRF
GOTO Decision
'GOSUB Display
```

```
ReadRF:
SERIN rxpin, baud, [WAIT("!"), cmd]
RETURN
```



Boe-Bot BS2 Program

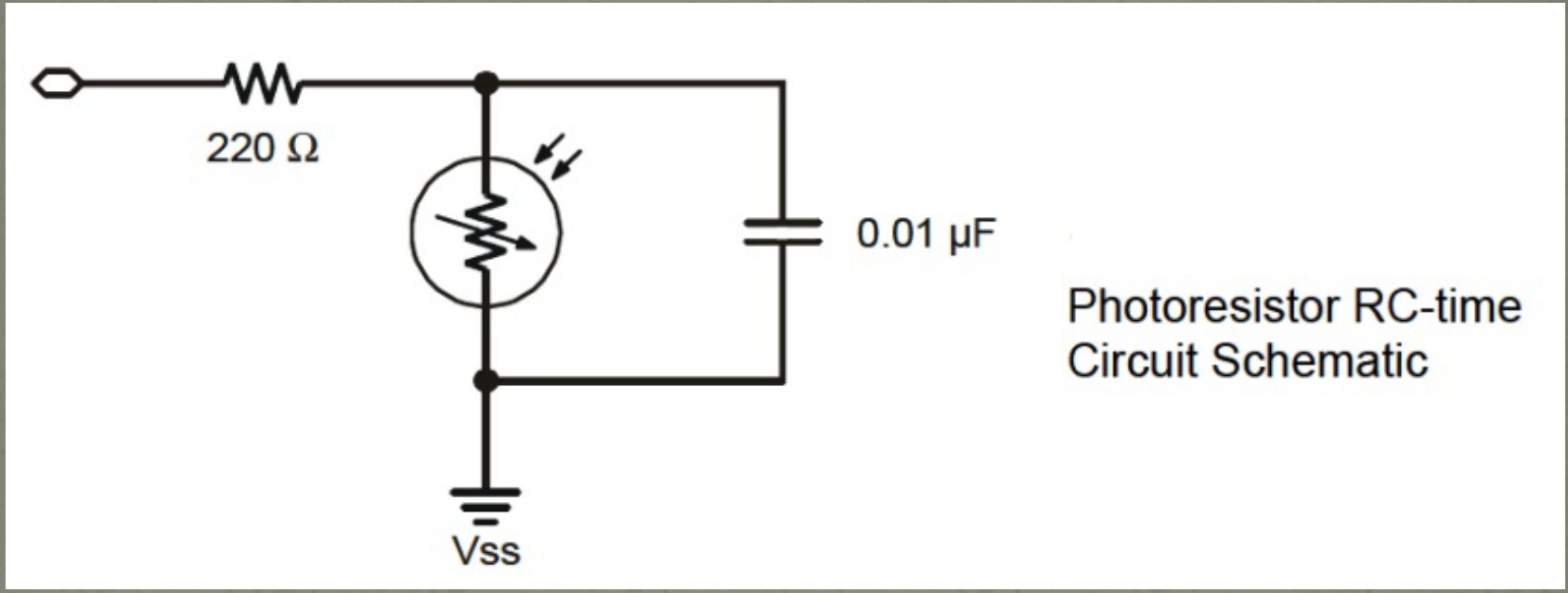
```
Decision:
DEBUG ? cmd
IF (cmd = 1) THEN
GOTO Forward
ELSEIF (cmd = 2) THEN
GOTO Rotate1
ELSEIF (cmd = 3) THEN
GOTO Rotate2
ELSEIF (cmd = 4) THEN
GOTO Backward
ELSE
GOTO NoMove
ENDIF
GOTO Main
```



Boe-Bot BS2 Program

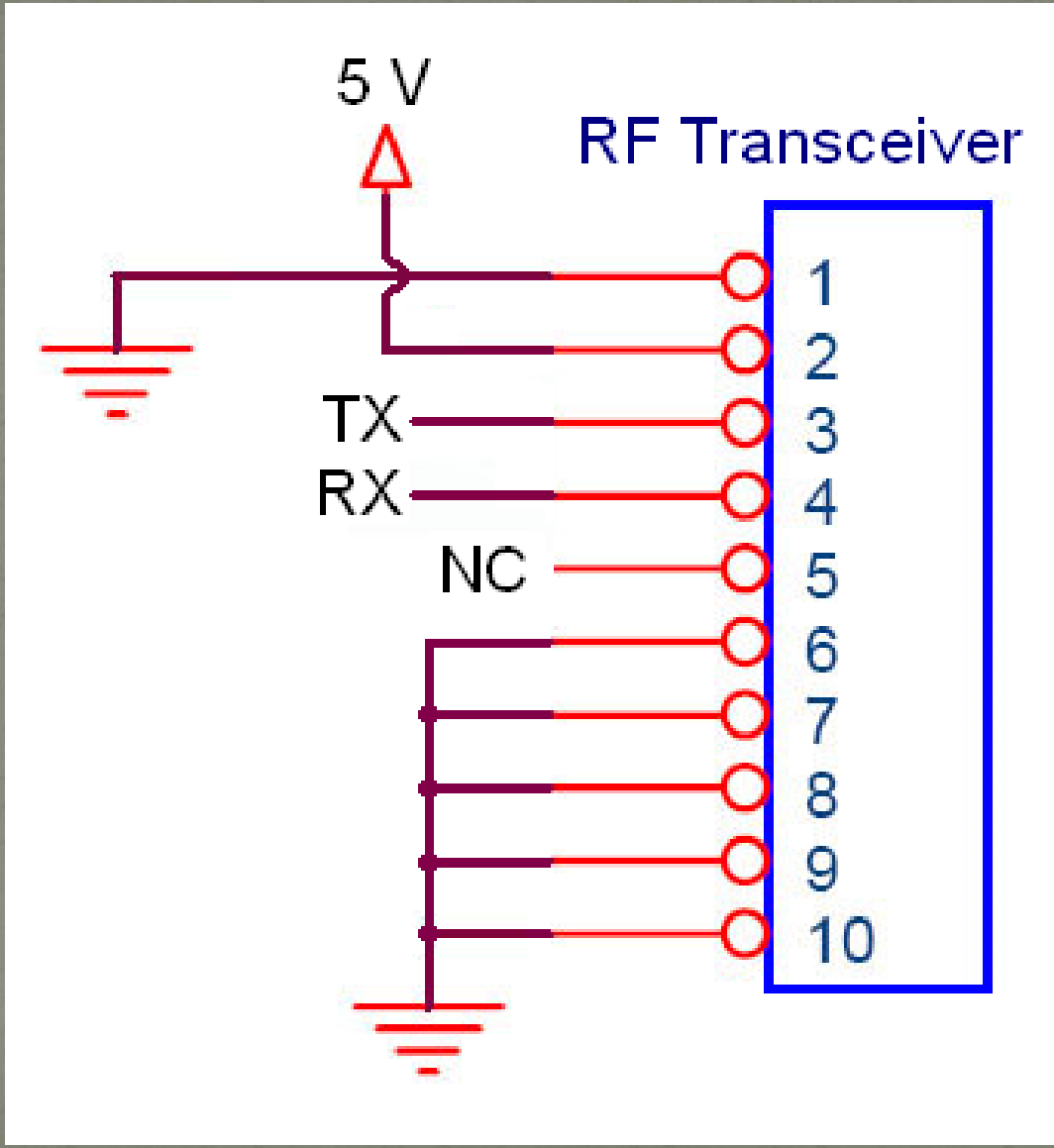
```
NoMove:
HIGH sensor
PAUSE 10
RCTIME sensor,1,light 'measure the light intensity on the sensor
'DEBUG ? light
PULSOUT txpin, 1200 'Sync pulse for the receiver
SEROUT txpin, baud, [ "!", light]
PAUSE 10
GOTO Main Forward:
PULSOUT 13, 850
PULSOUT 12, 650
PAUSE 15
GOTO Main
```

Circuits



Photoresistor RC-time
Circuit Schematic

Circuits



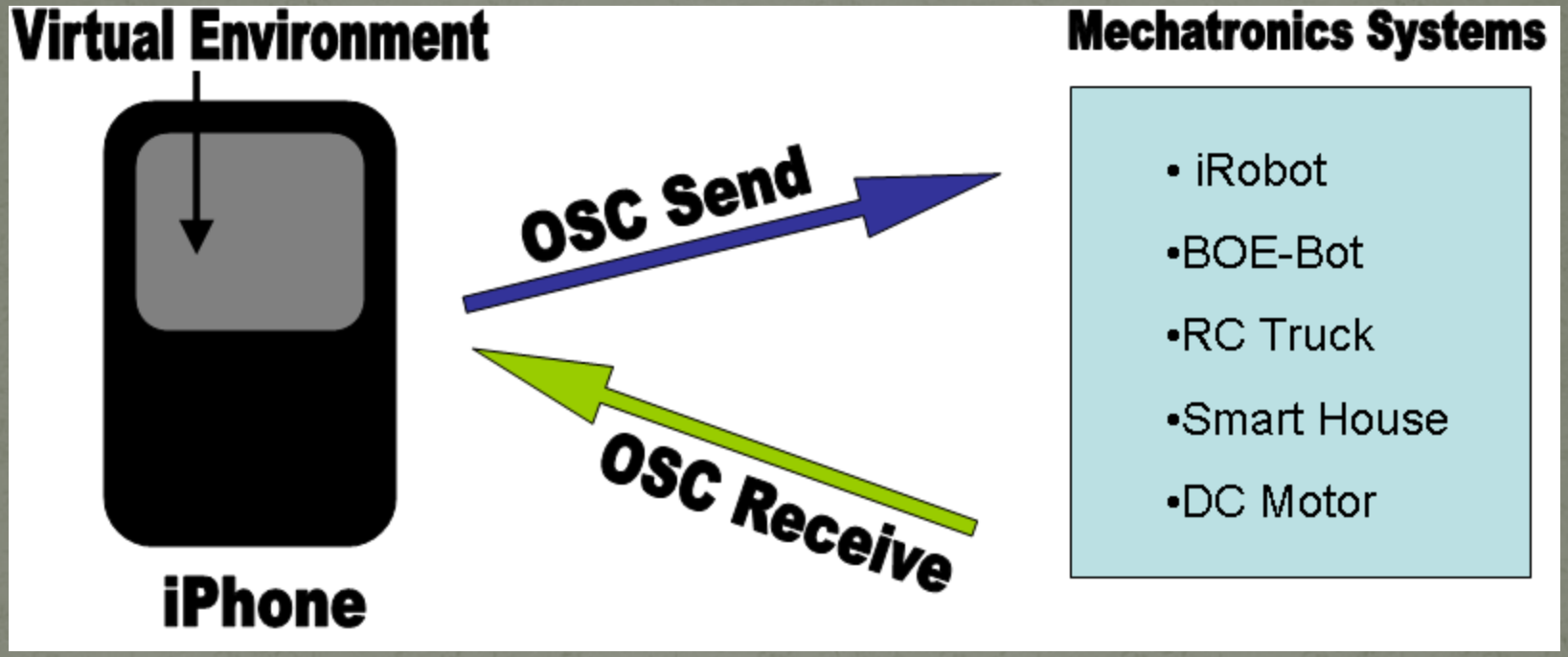
Conclusions
Last Summer's Long-term Goals

- Data Acquisition
- Control ✓
- Experiment/Equipment communication ✓
- BASIC Stamp interfacing ✓
- A remote CPU for mechatronics applications

Conclusions

- Removed the Router/MAKE from the project
- Discovered communication with MATLAB/Simulink
  - For interfacing with lab equipment/experiments.
- Designed and Built DAC platform
  - For interfacing any RF mechatronic/robotic project.

Conclusions and Future Goals



Future Goals

- Receiving and displaying data on the iPhone
- Programming a custom iPhone graphical user interface
- Alternative methods of communication and control
- Using iPhone sensors (accelerometer, compass, GPS…)
- Direct iPhone ←→ MATLAB
- More advanced applications
  - CRS Robotic Arm
  - RC Airplane
  - Robotic Fish