Collaborative Processing in Sensor Networ

Lecture 8 – MSP 101

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What is MSP?

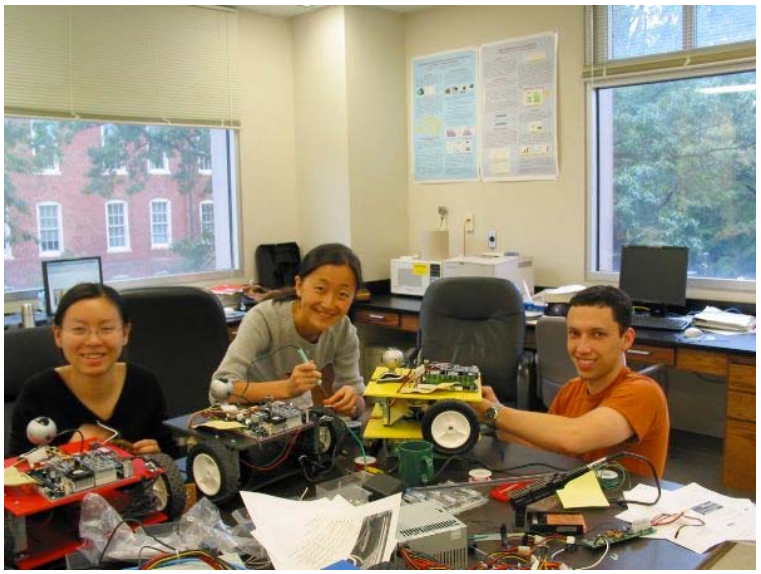
Mobile **S**ensor **P**latform

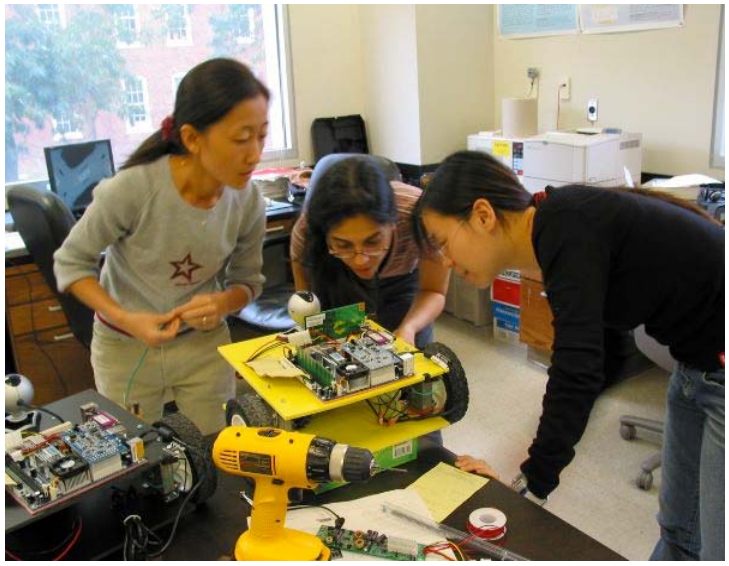
- Mobility
- Integrated capabilities of sensing
- On-board processing capability
- Wireless communication
- Cost-effective

History of MSP Design

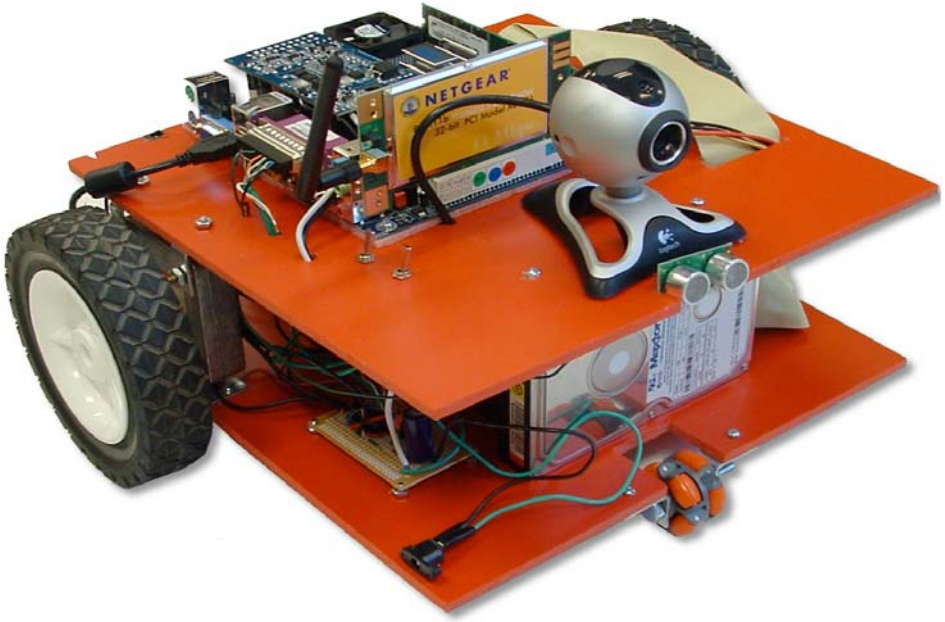
- MSP v1.0 - Spring 2004
  - ECE491 Design Project (Visionaries)
- MSP v2.0 - Fall 2005
  - MS thesis by Chris Beall
  - Adding Ranging Sensor
- MSP v2.5 - Spring 2006
  - ECE692 Design Project by Austin Albright
  - Adding a Servo for the range Sensor
- MSP v3.0 - Summer 2008
  - Standardized all works
  - Adding a Servo for the camera

History of MSP Design





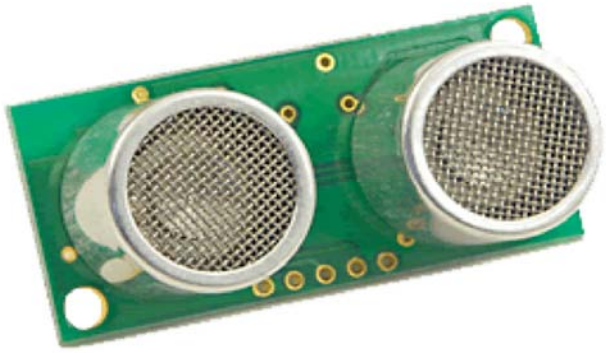
System Facts



- Dimension: 300x400x200 cm
- Cost: ~ $500 each
- Battery Life: ~ 3 hours
- 1.5 GHz processor
- 1 GB of RAM
- 30 GB Harddisk
- Operating system: Linux

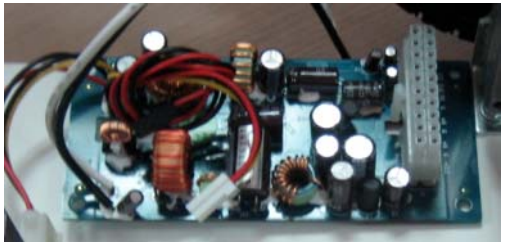
Sensing Units

- MSP is equipped with two kinds of sensors
  - Imaging sensor
    - Logitech Pro 5000
  - Range sensor
    - Ultrasonic rangefinder SRF05



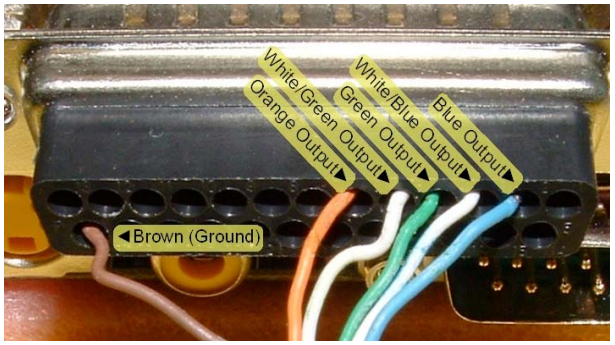
Processing

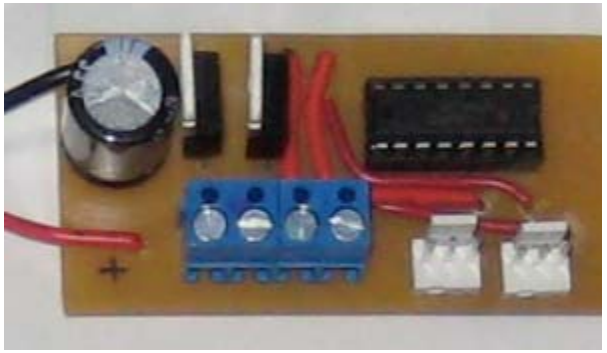
- Mini-ITX (7x7in) form factor motherboard - VIA CN700
- 1.5GHz processor
- Room for one memory module
- Integrated video, audio, ethernet
- PCI expansion slot (used for wireless)
- Needs an external Power Supply



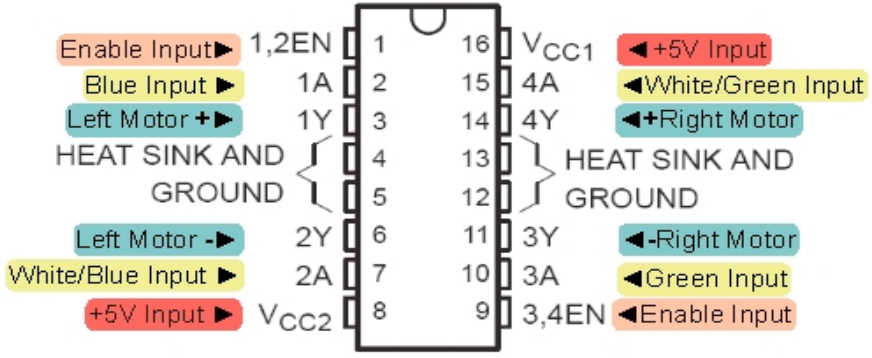
Motor Control

- The parallel port is used to send a PWM signal to the H-Bridge IC which directly drives two motors



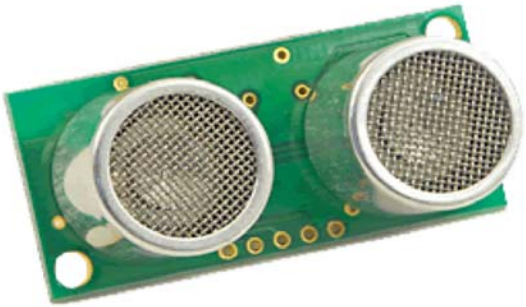


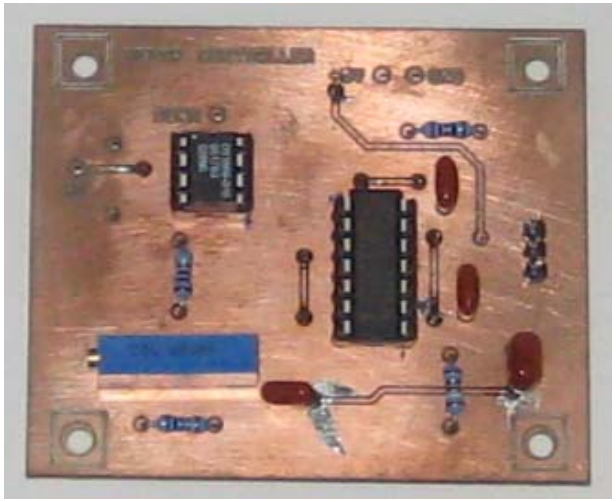
(TOP VIEW)



Range Sensor & Servo Control

- SRF05 Ultrasonic Ranger
  - The parallel port is used.
  - Input: Power & Trigger signal
  - Output: Echo signal
  - Range: 3cm - 4m
- HITEC HS-311 Servo
  - Turns: 180 degree
- Servo Controller Circuit
  - Digital Potentiometer
  - 556 dual timer IC





Software

- Operating System: Linux
  - Ubuntu 7.04 ➔ Ubuntu 8.04
- Wireless Card Driver
  - To be supported by Linux, or
  - use Ndiswrapper
- Remote Access protocol: SSH Secure Shell
  - Log into a remote machine and execute commands
  - File transfer
- Camera
  - To be supported by Linux,
  - Use Logitech, **DO NOT** use Microsoft

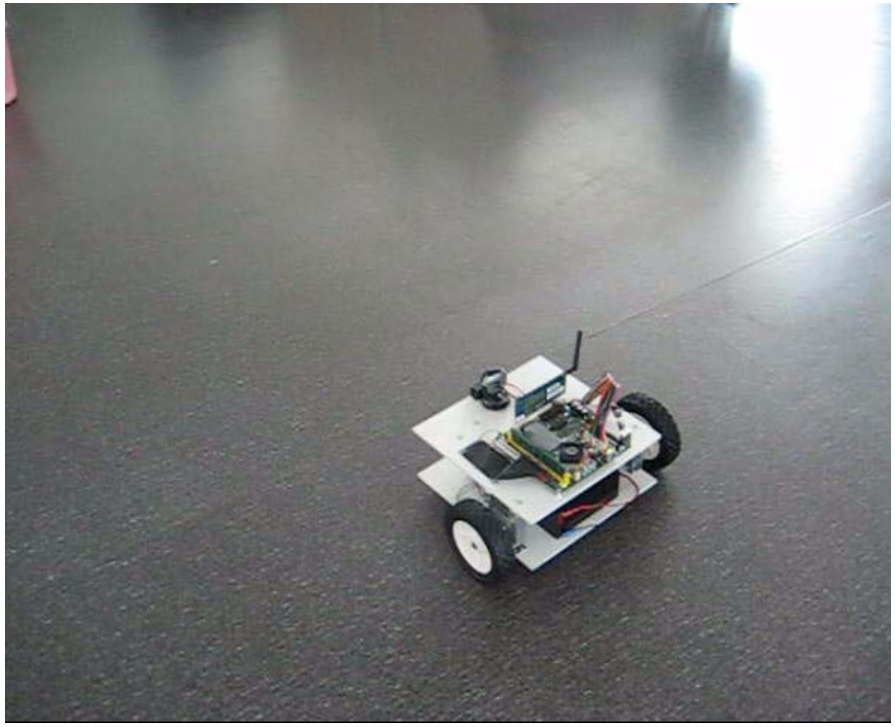
Projects & Demos

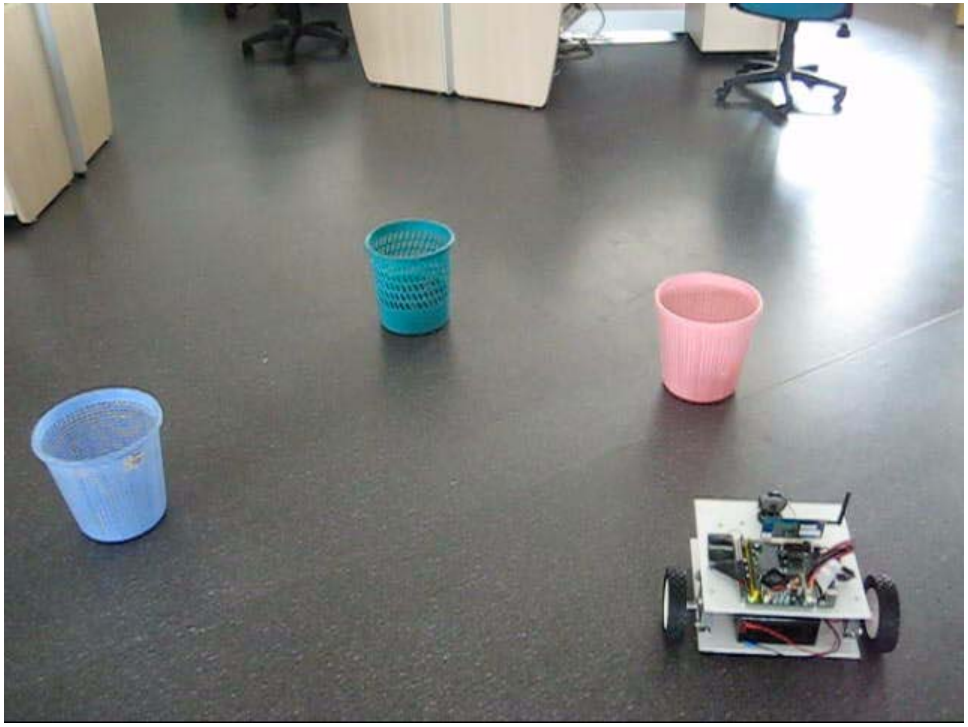
AICIP RESEAR

- Component testing
  - Motortest
  - Range Sensor Test
- Self-localization demo
  - Using ARTool Kit
- Parallel dancing demo
  - Class project demo from ECE453, Fall 2005
- Target recognition demo
  - Class final project demo from ECE692, Spring 2004
- Self-deployment demo - Distributed vs. Centralized
  - Chris Beall's MS defense demo, Summer 2006

Component Testing

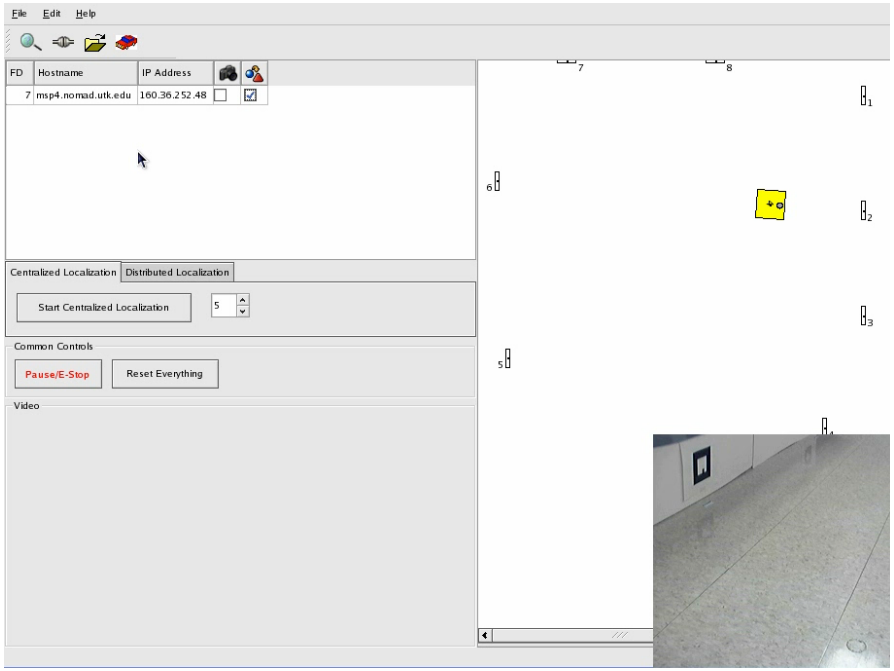
- Motor Test
- Range Sensor Test





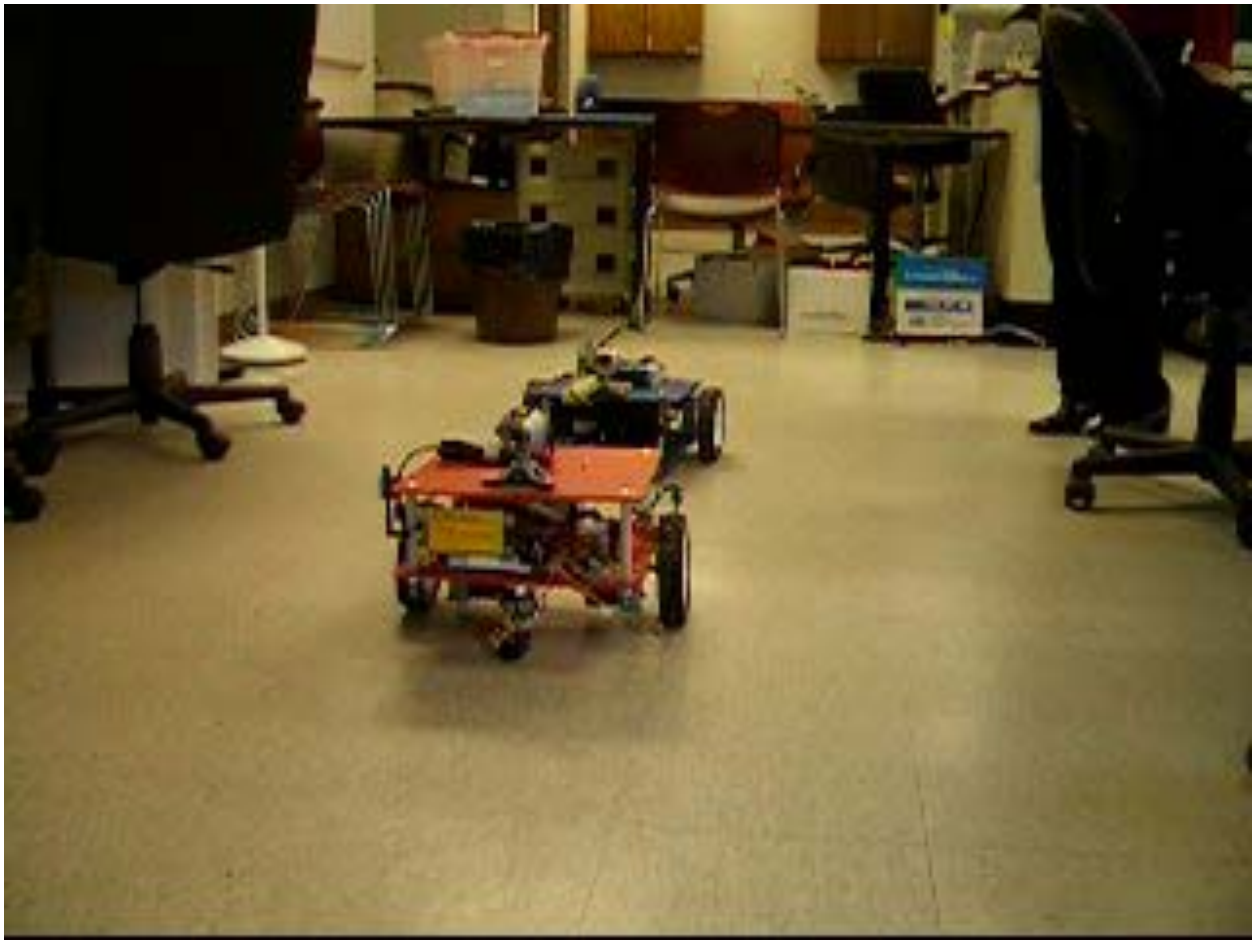
Self-localization demo

- Using ARTool Kit



Parallel dancing

- Class project demo from ECE453, Fall 2005

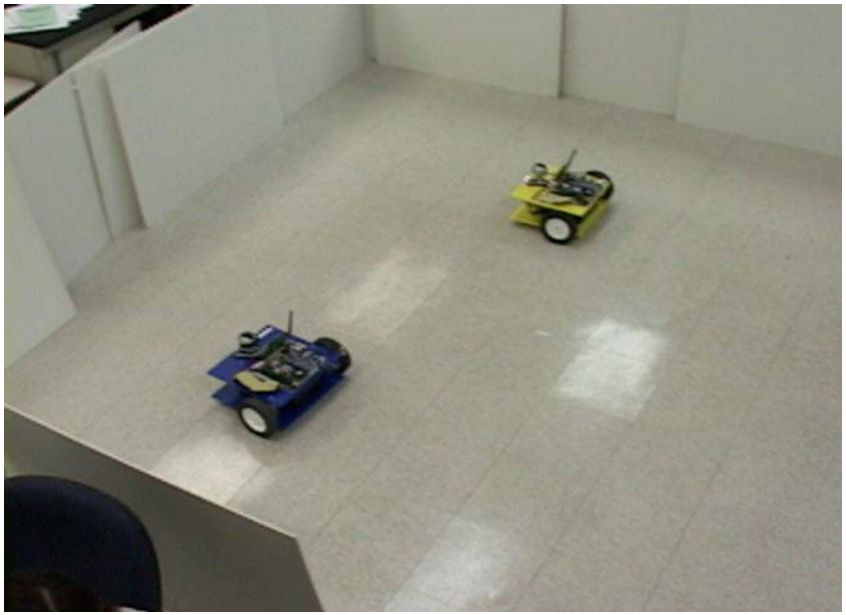


Target recognition

- Class final project demo from ECE692, Spring 2004

Self-deployment

- Centralized vs. Distributed
  - Chris Beall's MS defense demo



Power Consumption of MSP

- Power OFF (Sleep Mode)
  - 0.14-0.15 A (1.68-1.8 W)
- Power ON (Idle Mode)
  - 1.82 A (21.84 W)
- Data Send/Receive
  - 1.92 A (23.04 W)
- Motors
  - Both: 2.22 A (26.64 W)
  - Left: 2.07 A (24.84 W)
  - Right: 2.01 A (24.12 W)

Questions & Future Work

- DC motors are not identical so feedback control is needed.
- Can step motor be used?
- Fix the problem in servo control circuit.
- Can smaller battery be used?
- Is MSP too big? Why not make it smaller?
- More info: http://panda.ece.utk.edu/wiki/MSP