

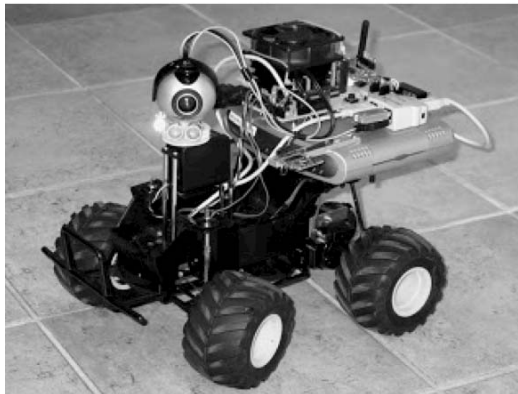


Computer Vision

Andy Gray

Objectives

- Hardware
- Hardware setup
- OpenCV
- Vision algorithms



(2)

Processing Devices

- Higher level platform
- Not a microcontroller!
- Laptop
- Desktop computer
- Tablet
- Smart phone
- Dev board



(3)

Things to think about

- Cost
- Power requirements
- OS support
- Resolution
- Low light
- Pan and tilt
- Weight
- User support



(4)

IP Cameras

- Generally used in surveillance
- Uses the network
- Wireless
- Power over Ethernet (POE)

- More expensive
- High network bandwidth
- Latency



(5)

D-Link DCS-931L

- \$32.99 on Amazon
- Daytime only



(6)

D-Link DCS-932L

- \$59.97 on Amazon
- Day and night



(7)

D-Link DCS-5010L

- \$75.99 on Amazon
- IR night vision
- Pan and tilt



(8)

Web Cameras

- Availability (phone, laptop)
- Wired/internal
- Cheap
- Powered over USB
- No network required
- Requires attached processing device



- <https://wiki.ubuntu.com/HardwareSupportComponentsMultimediaWebCameras>

(9)

PS3 Eye

- \$7.99 on Amazon
- Daytime only
- Good resolution (640x480)
- Fast frame rate



(10)

Creative Live! Cam Chat HD

- \$20.84 on Amazon
- Daytime only
- High resolution (720p)



(11)

Logitech C920

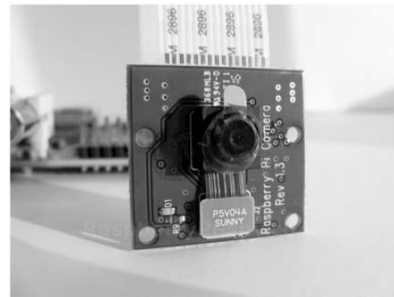
- \$69.99 on Amazon
- Daytime
- Higher resolution (1080p)
- Lots of control



(12)

Raspberry Pi Camera

- \$14.99 on Amazon
- Daytime
- Higher resolution (1080p)
- Faster than USB



(13)

Raspberry Pi Camera

- \$33.90 on Amazon
- Daytime/Night time
- Higher resolution (1080p)
- Faster than USB



(14)

Smart Phone

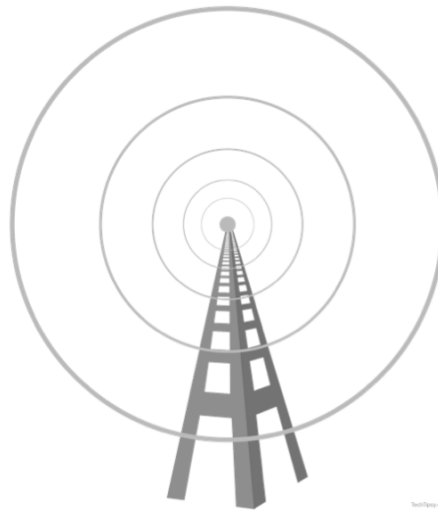
- Availability
- Free (if you own one)
- No network required
- Processing device attached
- Steeper learning curve
- Less hardware choices



(15)

Wireless Communication Devices

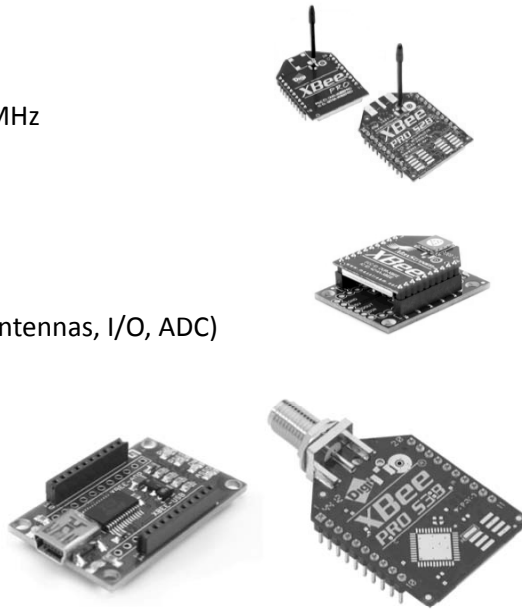
- Required
- Lower bandwidth
- Less reliable
- Radio, sound, light



(16)

Digi Xbee

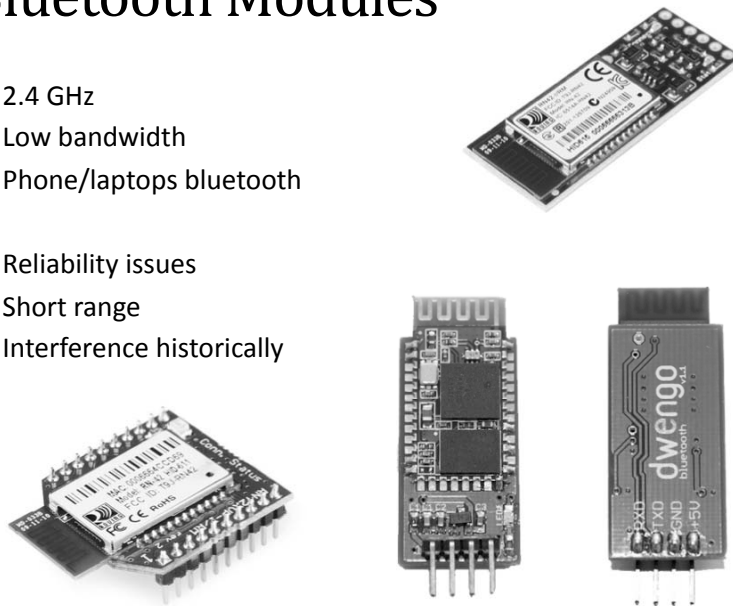
- 2.4 GHz and 900 MHz
- Low bandwidth
- Easy to use
- Very reliable
- Long range
- Lots of features (antennas, I/O, ADC)
- Expensive
- Require at least 2



(17)

Bluetooth Modules

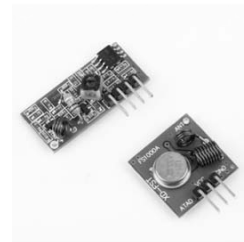
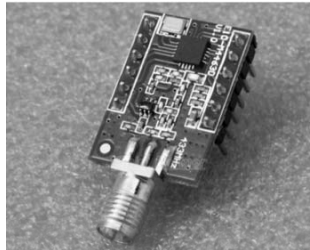
- 2.4 GHz
- Low bandwidth
- Phone/laptops bluetooth
- Reliability issues
- Short range
- Interference historically



(18)

433 MHz Transmitters

- Cheap (\$0.99)
- Long range
- Low bandwidth
- Subject to noise
- Less common



(19)

Wifi (for serial communication)

- 2.4 GHz
- High Bandwidth
- <http://nmap.org/ncat/>
- Not common
- Requires two wireless modules



NetCat



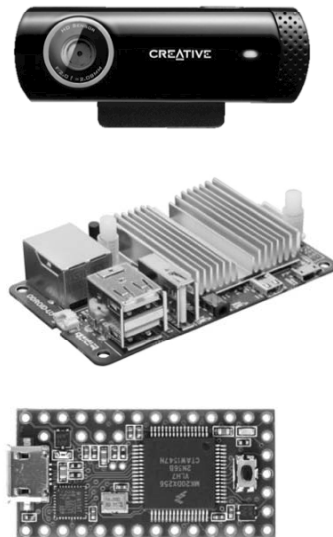
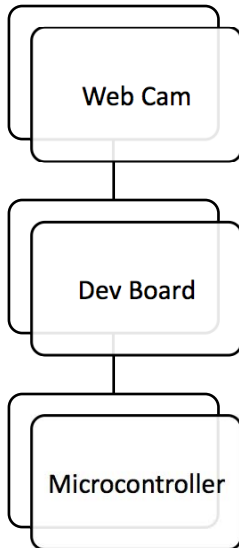
(20)

Setup 1



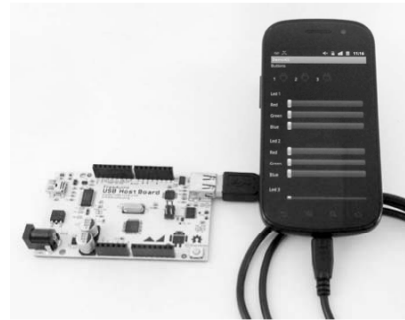
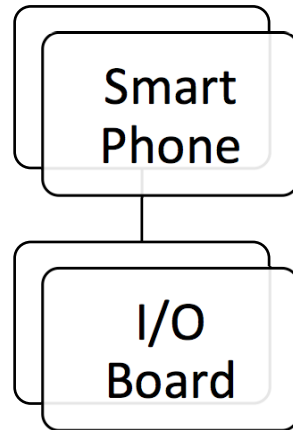
(21)

Setup 2



(22)

Setup 3



(23)

OpenCV

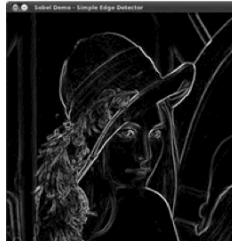
- Open Source Computer Vision (OpenCV) Library
- Intel, 1999
- New processors
- Open-source 2006 (Willow Garage / Itseez)
- Computer vision easier
- C++, C, Android, Python
- Multi-platform
- OpenCV 3.1



(24)

Vision Algorithms

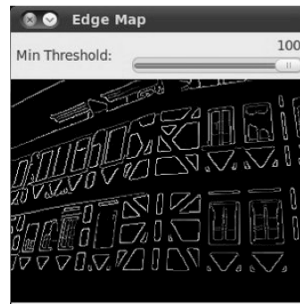
- Sobel Derivatives (edge detection)



(25)

Vision Algorithms

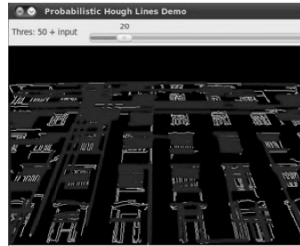
- Canny edge detector



(26)

Vision Algorithms

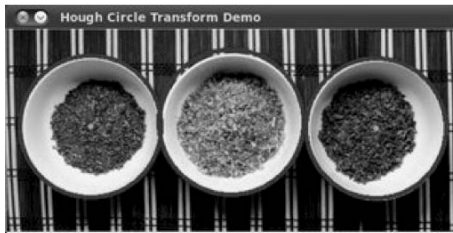
- Hough line transform (line detection)



(27)

Vision Algorithms

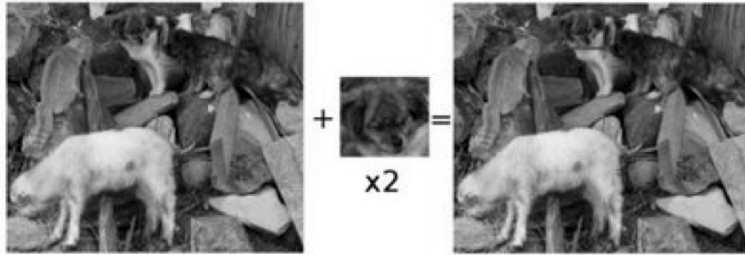
- Hough circle transform (circle detection)



(28)

Vision Algorithms

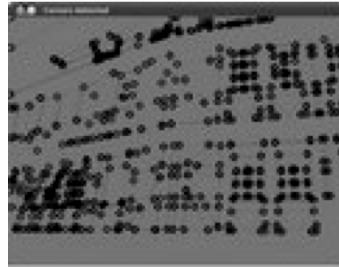
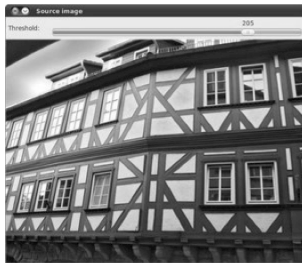
- Template matching



(29)

Vision Algorithms

- Harris corner detector



(30)

Vision Algorithms

- Convex Hull



(31)

Vision Algorithms

- Speeded up robust features (SURF)



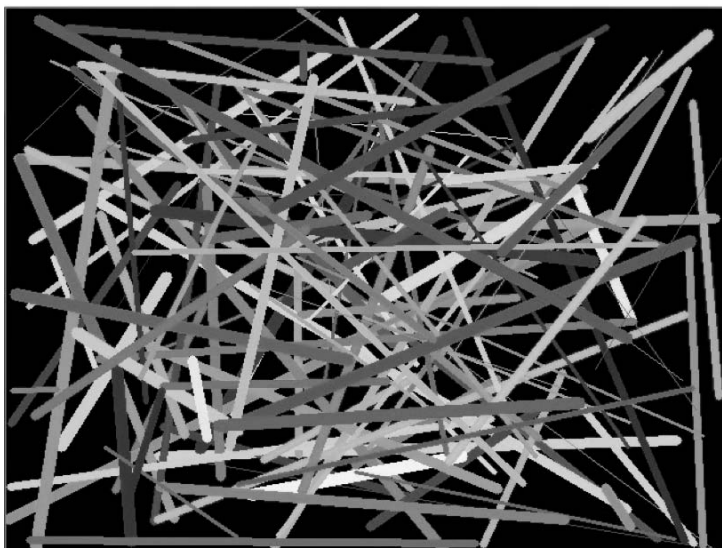
(32)

Links

- SURF
- <https://www.youtube.com/watch?v=L0nOwF2nL0c>
- OpenCV Python Tutorials
- <https://opencv-python-tutroals.readthedocs.org/en/latest/index.html>

(33)

Questions



(34)