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Geek Night 09

shoot 'm up

.NET & hardware –
capture video & control servos
in a fun application

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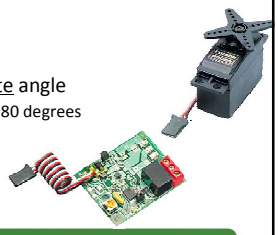
Shoot 'm up

Ingredients

1	USB webcam	1	Visual Studio 2008
2	Servo motors		
1	Servo relay		
1	USB servo controller	n	Downloads
1	Battery pack	*	Lots of fun!
1	Laser pointer		

Servos(1)

- Two kinds of servos:
  - Servo motors
    - Turn towards an absolute angle
      - Usually between 0 and 180 degrees
  - Servo relays
    - Can be turned on or off

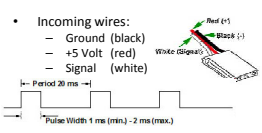


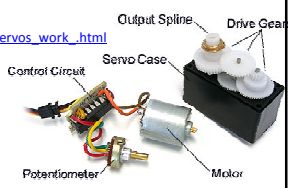
Servos(2)

- These are the same servos used in the RC model building world
  - http://en.wikipedia.org/wiki/Radio_controlled_model
- Are
  - Accurate
  - Controlled by pulse-width modulation

How do servos work?

- http://www.servocity.com/html/how_do_servos_work_.html
- Incoming wires:
  - Ground (black)
  - +5 Volt (red)
  - Signal (white)





- Signal is PWM (Pulse Width Modulation)
  - Every 20 milliseconds a pulse
  - Pulse width = 1 milliseconds: go to 0 degrees
  - Pulse width = 1.5 milliseconds: go to 90 degrees (default)
  - Pulse width = 2 milliseconds: go to 180 degrees

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Servos used

- Servo motors:
  - Futuba / Robbe S3003 servo motor
    http://www.etteam.com/product/1602.html
    http://duteela.et.tudelft.nl/~elca/XilinxTutor/documents/FutabaS3003.pdf
- Servo relay
  - Robbe Mono-Switch 8444
    http://data.robbe-online.net/robbe_pdf/P1122/P1122_1-8444.pdf
  - (also available as Duo-Switch 8445)

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Controlling servos

- In the RC model building world, lots of solutions are available
- In the PC World: Servo controller
  - Takes away all of the "PWM" pain

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Servo controller

- Device that:
  - Connects to a PC
  - Sends out PWM servo signals to a number of servo devices
- Pololu makes them
  http://www.pololu.com/catalog/category/12
  - Serial
  - Serial over USB

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USB Servo's - software

- Colin Carpfinger wrote some foundation stuff
  - http://www.colinkarpfinger.com/pololu/
- Adapted
  - More stable
  - Better exception handling
  - More intuitive UI
  - See demo later…

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Our Shoot 'm Up device

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Our Shoot 'm Up device

- Positioning
  - Vertical 1600 – 4200 -> 2600 steps
  - Horizontal 750 – 4700 -> 3950 steps
  - Ratio ~ 2:3
- Laser thresholds
  - On: Values >= 3415 (varies a bit over time)
  - Off: Values <= 3305 (varies a bit over time)

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USB Servo demo (1)

- Detecting USB Servo Controller
  - Detect COM ports
  - Detect USB COM ports
- Sending servo information
  - Baud rate
    - is always 9600!!!
  - Select servo port
  - Send command
    - Pololu protocol: Range + Speed
    - SCC protocol: Range only

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USB Servo Demo (2)

- Spatial movement
- Laser pointer

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USB Camera's

- Cheap (like Logitech QuickCam Chat)
  - Low resolution (320 x 240 .. 640 x 480)
  - Low light usually not so good
  - Mostly supported on Windows XP out of the box
    - Vista usually requires extra drivers
- More expensive (like Microsoft LifeCam VX-6000 or Logitech QuickCam Pro 9000)
  - Higher resolutions (800 x 600 and up)
  - Wide angle lenses
  - Often auto focus
  - Can cope with low-light better
  - Almost always have their own drivers
    - Usually a lot of bloatware

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AForge library

- AForge
  - AForge.Imaging – image processing routines & filters;
  - AForge.Neuro – neural networks computation;
  - AForge.Genetic – evolution programming;
  - AForge.Vision – computer vision;
  - AForge.MachineLearning – machine learning.
- Base
  - http://code.google.com/p/aforge/
- Download
  - http://aforge.googlecode.com/files/AForge-1.6.3.exe

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AForge Articles

- Introduction
  - http://www.codeproject.com/KB/recipes/aforge.aspx?display=Print
- Motion detection
  - http://www.codeproject.com/KB/audio-video/Motion_Detection.aspx?display=Print
- Hands Gesture Recognition
  - http://www.codeproject.com/KB/audio-video/hands_gesture_recognition.aspx?display=Print
- Time lapse video recorder
  - http://igor.moochnick.googlepages.com/timelapsevideorecorder
- Water Hobo
  - http://www.waterhobo.com/
- Rear View Mirror
  - http://penguindreams.org/page/see/Rear%20View%20Mirror
- Image processing
  - http://www.codeproject.com/KB/GDI-plus/Image_Processing_Lab.aspx?display=Print
- Surveillance
  - http://www.codeproject.com/KB/audio-video/VisualSLPart1.aspx?display=Print
  - http://www.codeproject.com/KB/audio-video/cameraviewer.aspx?display=Print

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Demo

- How to grab video source
  - CameraWindow
  - VideoSource selection
- How to react on motion
  - Select motion detection algorithms
  - Timers
- Coordinate conversion
  - Viewports…

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Next steps…

- Read more on wiert.wordpress.com and download the code…
- Visit interesting sessions on Friday:
  - 13:30 Embrace Open Source on CodePlex
    Sara Ford Lv.300 Atlantic
  - 13:30 Make Yourself Rich with XNA
    Rob Miles Lv.300 Yangtze 1&2
  - 16:40 Surface Development
    Neil Roodyn Lv.300 Everest 1&2

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Questions?

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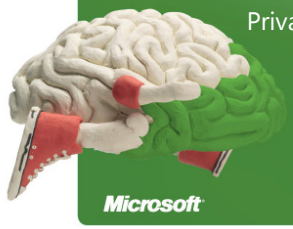

Microsoft www.microsoft.nl/devdays