CEC Continuing Education Center

DesignNews

Getting Hands-On With Automated Inspection Concepts Using AI-Based Smart Cameras

Introduction To The Pixy2 Camera: Part 1

Sponsored by

DigiKey

informa markets

Webinar Logistics

- Turn on your system sound to hear the streaming presentation.
- If you have technical problems, click “Help” or submit a question asking for assistance.
- Participate in ‘Attendee Chat’ by maximizing the chat widget in your dock.

Dr. Don Wilcher

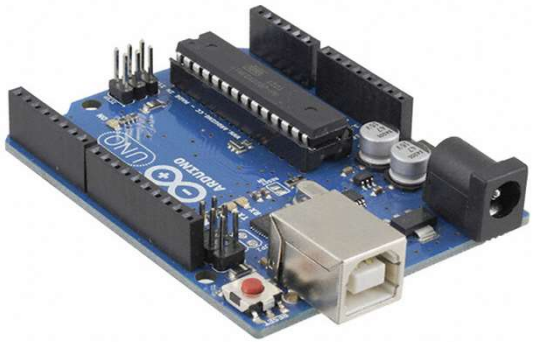
Visit ‘Lecturer Profile’ in your console for more details.

Course Kit and Materials

Pixy2 CMUCAM5

Pan/Tilt2 Servo Motor Kit for Pixy2

Arduino Uno Rev 3



M5Stack AI Camera

M5GO IoT Starter Kit V2.7

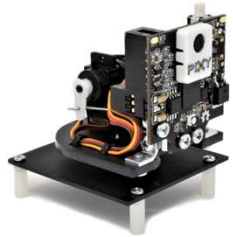
Agenda:

- Survey of Industrial Applications
- Marker Based Augmented Reality
- Lab: Teaching Pixy2 Camera for Object Detection and Recognition

Seminal Research Perspective

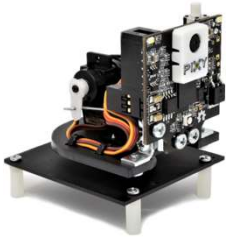
"Inspections are performed in virtually every production system. Their purpose is to verify that the production operations were carried out properly and that the production output meets the expectations of the customer" (Ben-Gal et al., 2002).

Survey of Industrial Applications



What are the Industrial Applications?

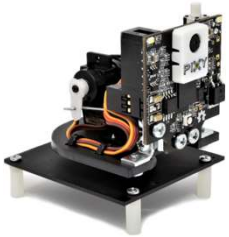
Survey of Industrial Applications



Vision Devices are used in the following industrial applications

- quality control
- robotics
- inspection
- Industrial safety
- pick and place

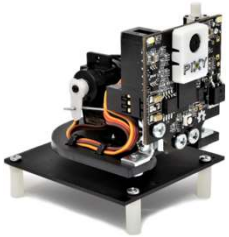
Survey of Industrial Applications. . .



Quality

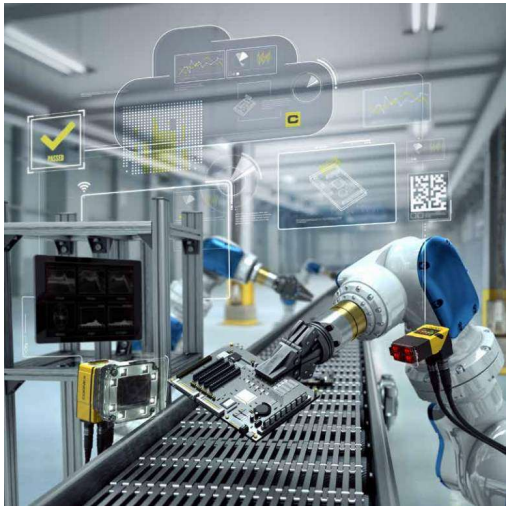
A machine vision system acquires images of an object, and then uses computers to process, analyze and measure various characteristics of that object.

Survey of Industrial Applications. . .



Robotics

Involves using a combination of camera hardware and computer algorithms to allow **robots** to process visual data from the world.

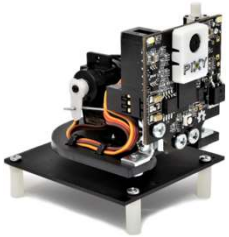


Question 1

What two industrial applications, listed on slide 8 are correct.

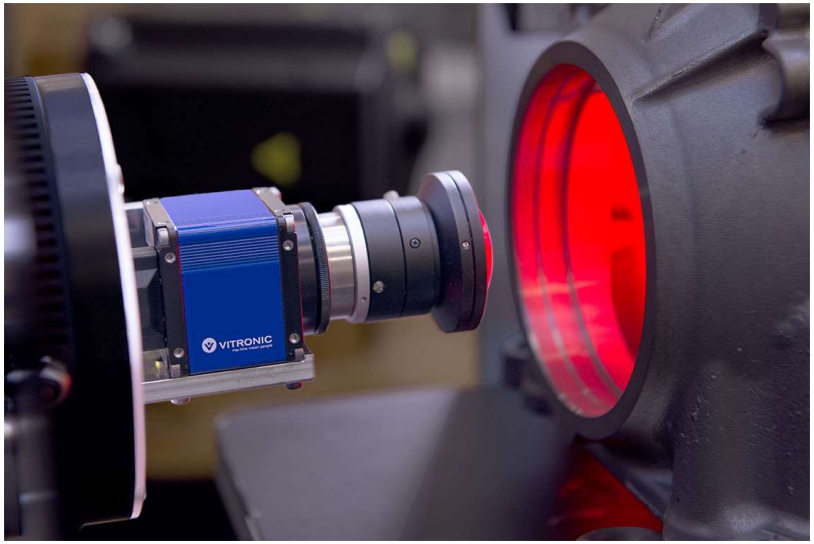
a) quality control, inspection
b) inspection, traffic light management
c) pick and place, industrial controls
d) none of the above

Survey of Industrial Applications. . .

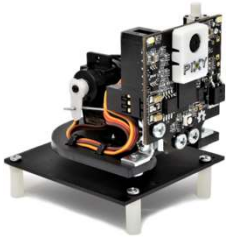


Inspection

Provide image-based inspection automated for your convenience for a variety of industrial and manufacturing applications.



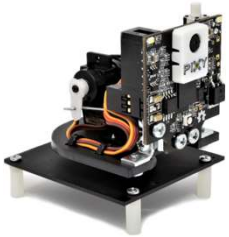
Survey of Industrial Applications. . .



Industrial Safety

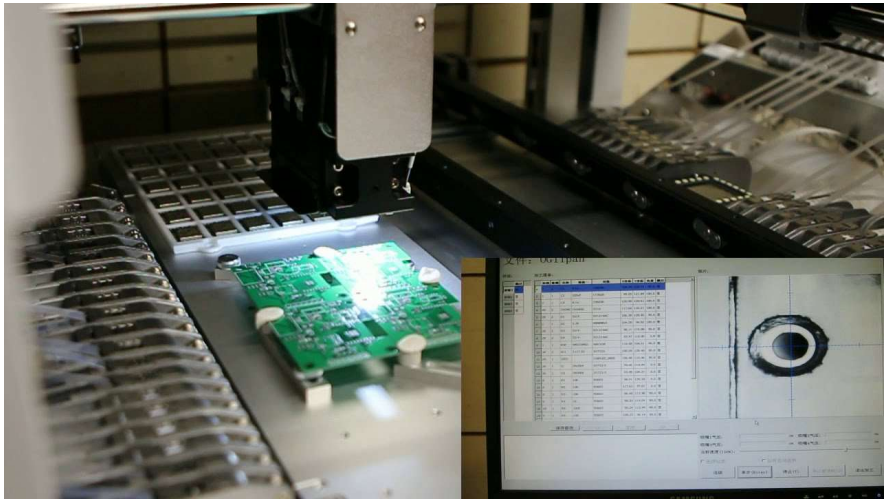
Defined as policies and protections put in place to ensure plant and factory worker protection from hazards that could cause injury.

Survey of Industrial Applications. . .



Pick and Place

Are robotic machines which are used to place surface-mount devices (SMDs) onto a printed circuit board (PCB).

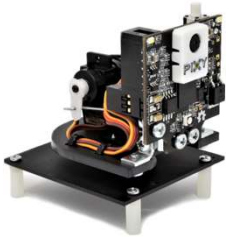


Question 2

Robotics involves using a _____ of camera hardware and computer algorithms to allow robots to process visual data from the world.

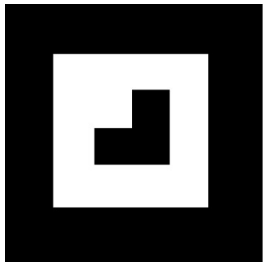
a) parts
b) bundle
c) combination
d) stack

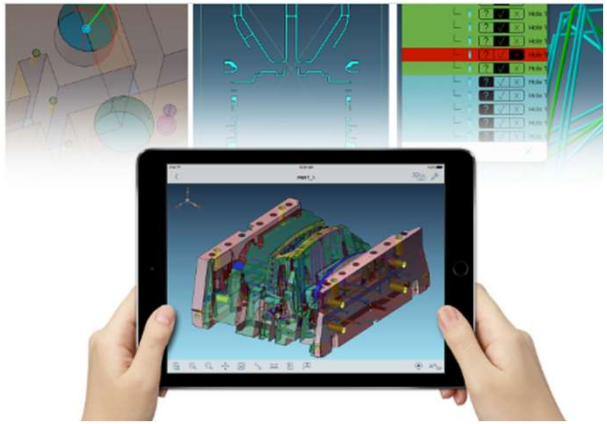
Marker Based Augmented Reality



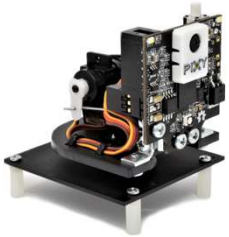
Marker Based Augmented Reality (AR) uses three basic components:

- Camera
- Marker
- Software





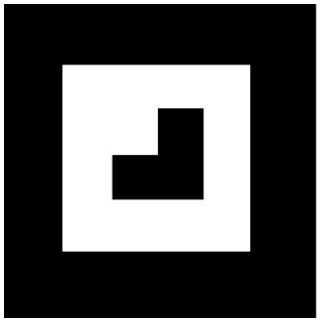
Marker Based Augmented Reality. . .



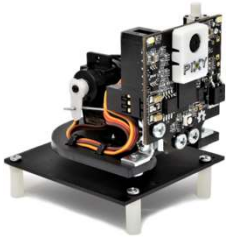
Simple Augmented Reality Marker

Consist of:

- one or more basic shapes.
- black squares against a white background.
- a camera
- a camera used with AR software to detect an augmented reality marker.



Marker Based Augmented Reality. . .

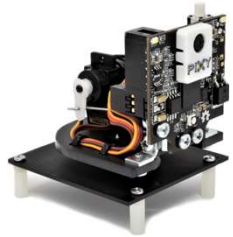


Simple Augmented Reality Marker

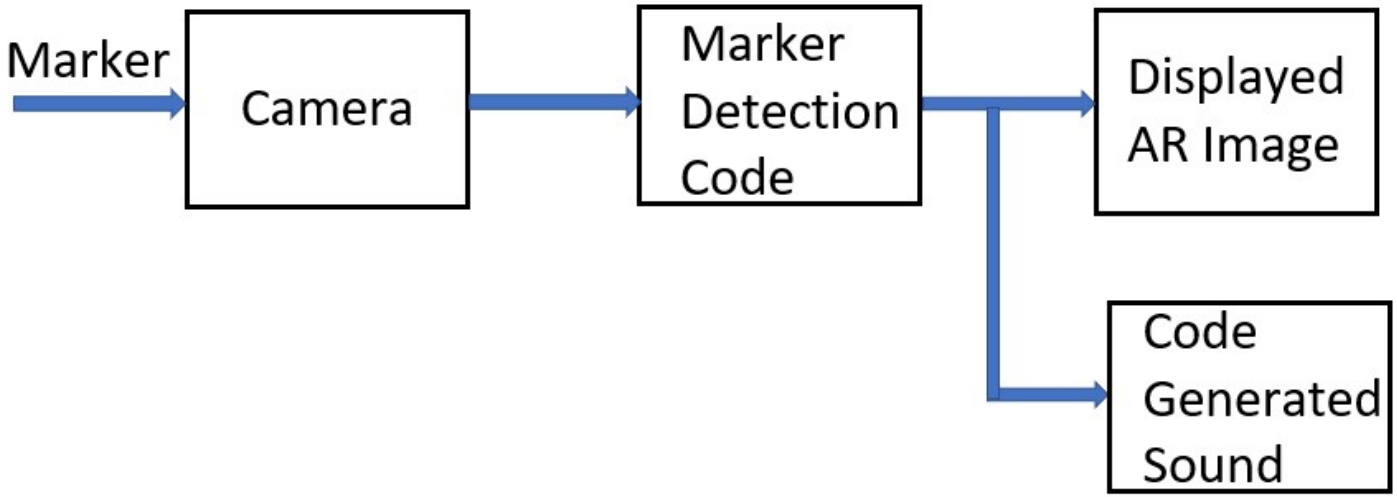
Simplest type of Augmented Reality Markers are

- black and white images.
- consist of two-dimensional barcodes.

Marker Based Augmented Reality. . .



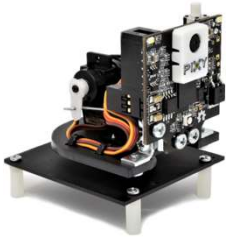
Simple Augmented Reality Marker System Architecture



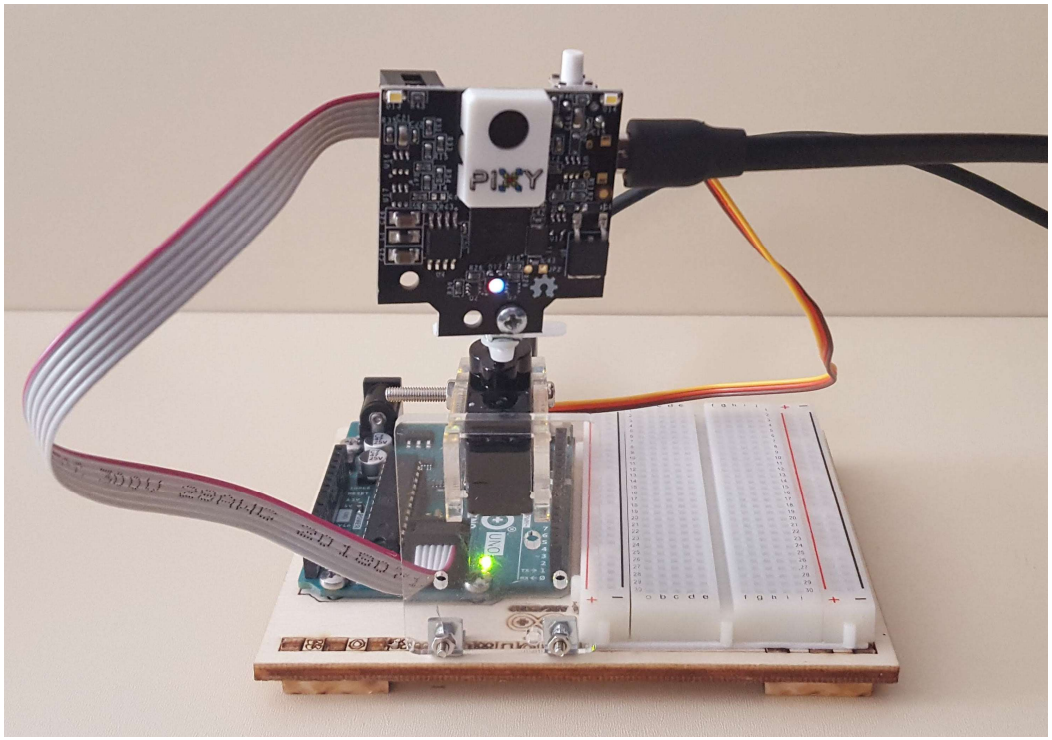
Question 3

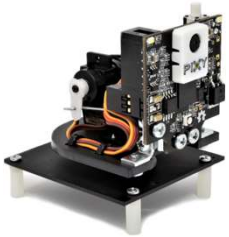
The simplest type of Augmented Reality Markers are

a) color images
b) gray and white images
c) consist of 3D barcodes
d) black and white images



Lab: Teaching Pixy2 Camera for Object Recognition and Detection



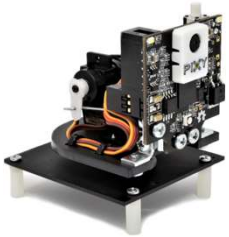


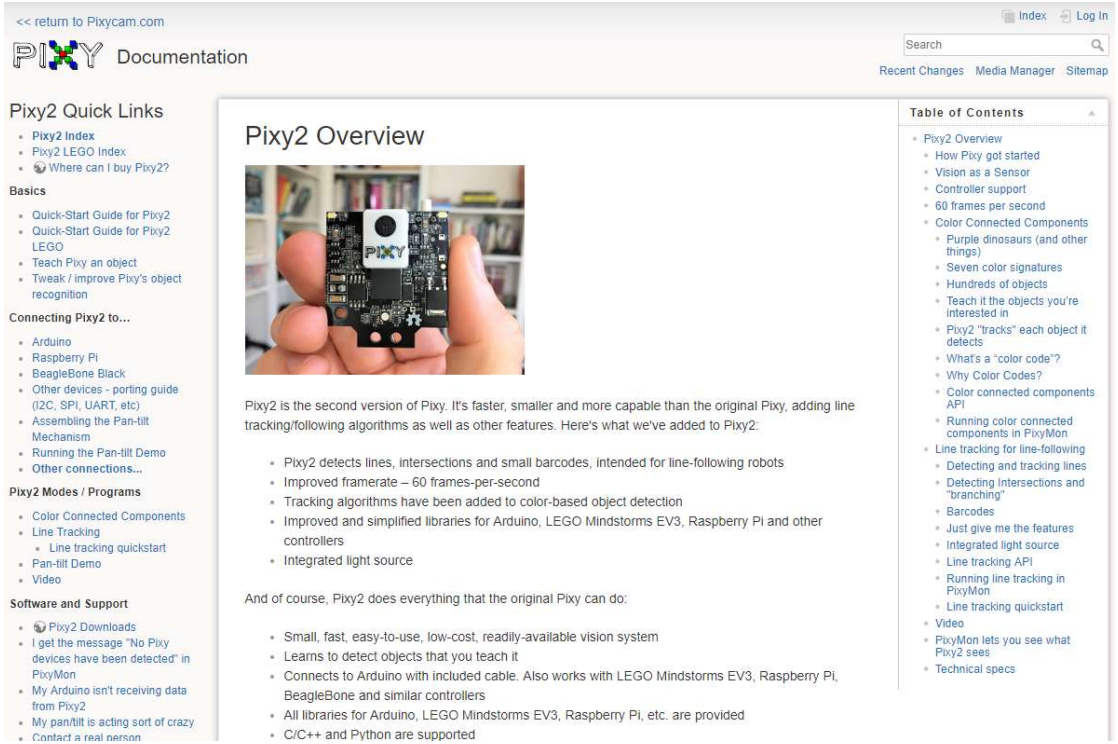
Lab: Teaching Pixy2 Camera for Object Recognition and Detection. . .

Lab Objectives:

- Participants will learn to connect the Pixy2 Camera to the PixyMon2 software tool.
- Participants will learn to connect with the Pixy2 Camera smart sensor.
- Participants will learn to train the Pixy2 Camera to detect an object.

Lab: Teaching Pixy2 Camera for Object Recognition and Detection. . .





<< return to Pixycam.com

Index Log In

PIXY Documentation

Search

Recent Changes Media Manager Sitemap

Pixy2 Quick Links

- **Pixy2 Index**
- Pixy2 LEGO Index
- Where can I buy Pixy2?

Basics

- Quick-Start Guide for Pixy2
- Quick-Start Guide for Pixy2 LEGO
- Teach Pixy an object
- Tweak / improve Pixy's object recognition

Connecting Pixy2 to...

- Arduino
- Raspberry Pi
- BeagleBone Black
- Other devices - porting guide (I2C, SPI, UART, etc)
- Assembling the Pan-tilt Mechanism
- Running the Pan-tilt Demo
- **Other connections...**

Pixy2 Modes / Programs

- Color Connected Components
- Line Tracking
  - Line tracking quickstart
- Pan-tilt Demo
- Video

Software and Support

- Pixy2 Downloads
- I get the message "No Pixy devices have been detected" in PixyMon
- My Arduino isn't receiving data from Pixy2
- My pan/tilt is acting sort of crazy
- Contact a real person

Pixy2 Overview

Pixy2 is the second version of Pixy. It's faster, smaller and more capable than the original Pixy, adding line tracking/following algorithms as well as other features. Here's what we've added to Pixy2:

- Pixy2 detects lines, intersections and small barcodes, intended for line-following robots
- Improved framerate – 60 frames-per-second
- Tracking algorithms have been added to color-based object detection
- Improved and simplified libraries for Arduino, LEGO Mindstorms EV3, Raspberry Pi and other controllers
- Integrated light source

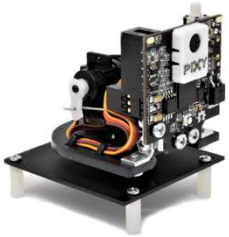
And of course, Pixy2 does everything that the original Pixy can do:

- Small, fast, easy-to-use, low-cost, readily-available vision system
- Learns to detect objects that you teach it
- Connects to Arduino with included cable. Also works with LEGO Mindstorms EV3, Raspberry Pi, BeagleBone and similar controllers
- All libraries for Arduino, LEGO Mindstorms EV3, Raspberry Pi, etc. are provided
- C/C++ and Python are supported

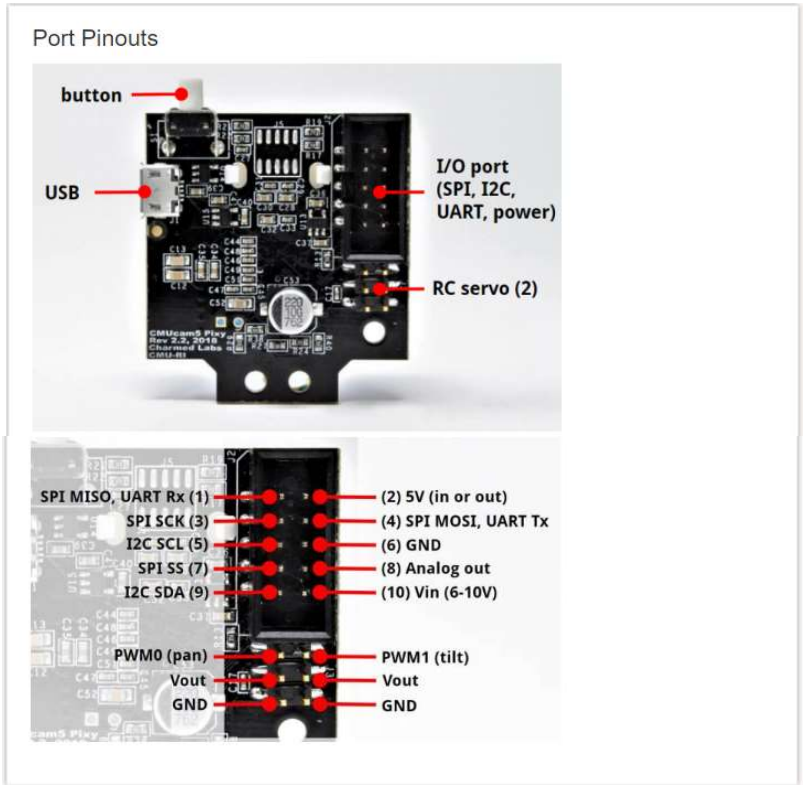
Table of Contents

https://docs.pixycam.com/wiki/doku.php?id=wiki:v2:overview

Lab: Teaching Pixy2 Camera for Object Recognition and Detection. . .



Pixy2 Port Pins



Lab: Teaching Pixy2 Camera for Object Recognition and Detection. . .

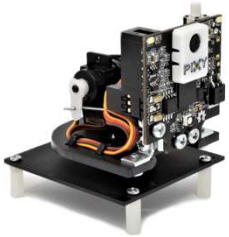
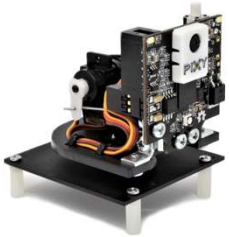


Table of Contents

1 2

Lab: Teaching Pixy2 Camera for Object Recognition and Detection. . .



PIXY PRODUCTS PROJECTS VIDEOS BUY SUPPORT BLOG ABOUT

Pixy2 Downloads

This page contains links to the most recent software/firmware releases for Pixy2. **These downloads will not work with the original Pixy!**

PixyMon v2

PixyMon v2 is the configuration utility for Pixy2 that runs on Windows, MacOS and Linux.

- Pixymon v2 Windows version 3.0.24 (exe)
  - installation docs for Windows Vista, 7, 8, 10
  - installation docs for XP
- PixyMon v2 Mac version 3.0.24 (dmg, High Sierra)
  - installation docs
- Linux Pixymon v2 is available through github
  - installation docs

Pixy2 firmware

Pixy2 firmware is code that runs on Pixy2 itself.

- Pixy2 general firmware version 3.0.13 (hex)
- Pixy2 LEGO firmware version 3.0.13 (hex)
  - installation docs

Arduino libraries and examples

The Arduino libraries allow your Arduino sketches/programs to talk to Pixy2.

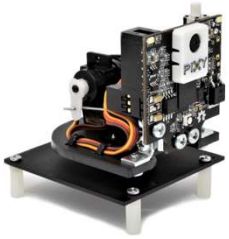
- Arduino Pixy2 library version 1.0.3 (zip)
  - installation docs

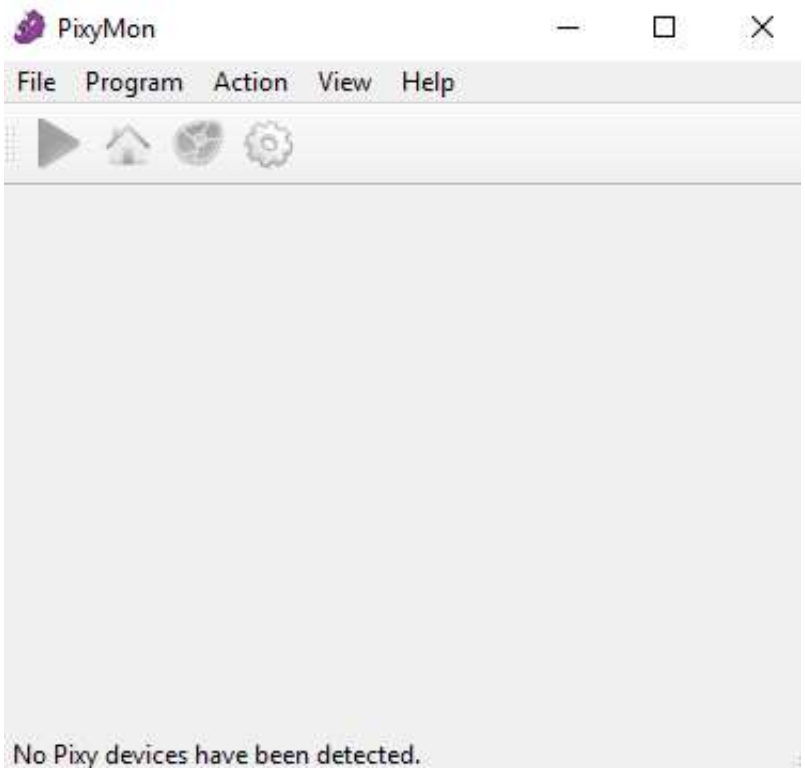
Libpixyusb2

Libpixyusb2 is a C/C++ library that allows your Linux-based controller (e.g. Raspberry Pi, BeagleBone) to talk to Pixy2 over USB.

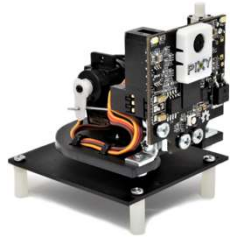
https://pixycam.com/downloads-pixy2/

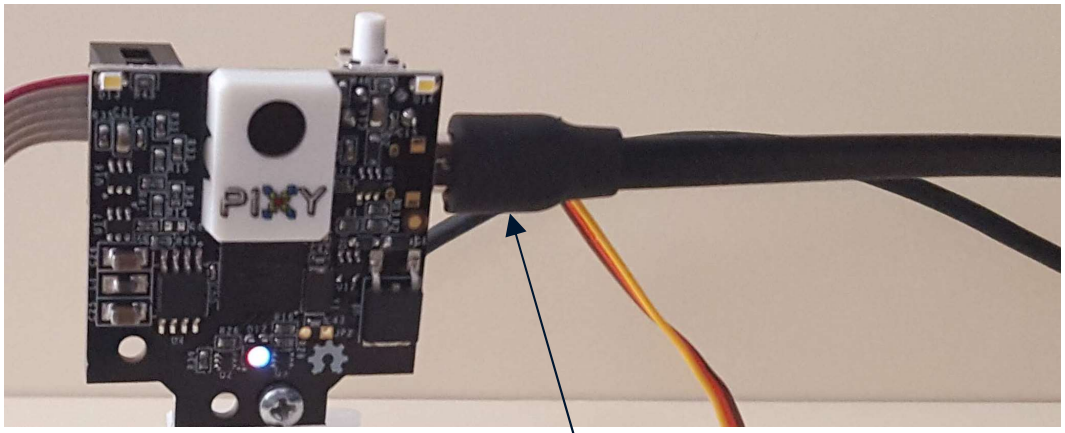
Lab: Teaching Pixy2 Camera for Object Recognition and Detection. . .





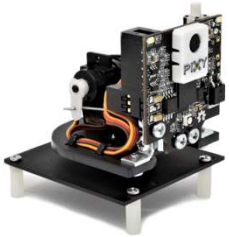
Lab: Teaching Pixy2 Camera for Object Recognition and Detection. . .

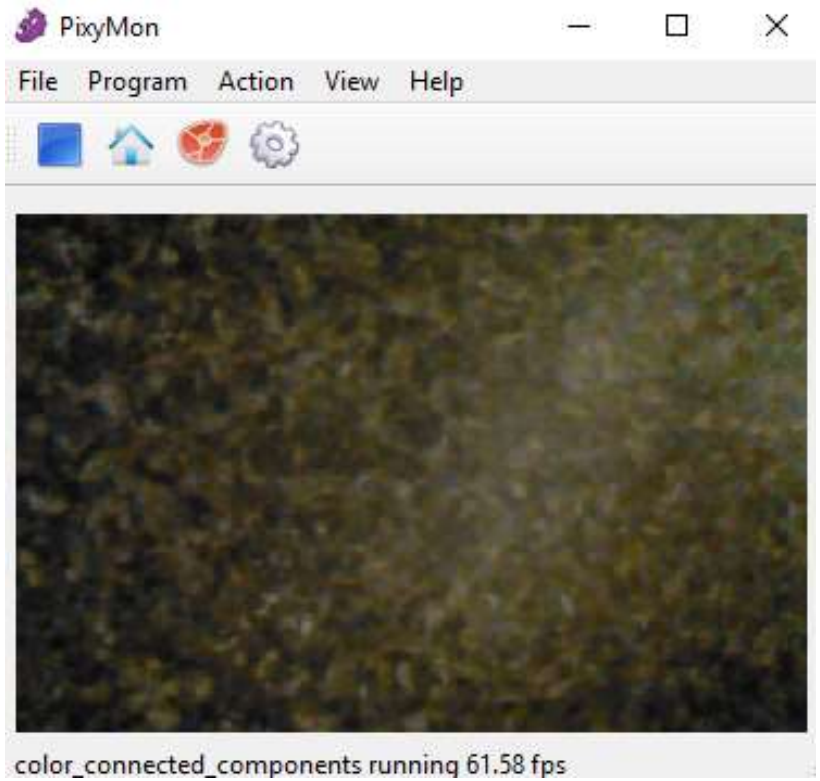




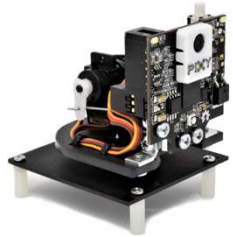
Connect Pixy2 Cam smart sensor to laptop computer via provided USB cable

Lab: Teaching Pixy2 Camera for Object Recognition and Detection. . .

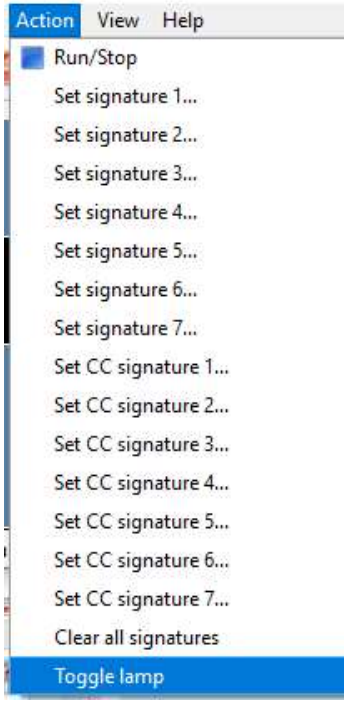


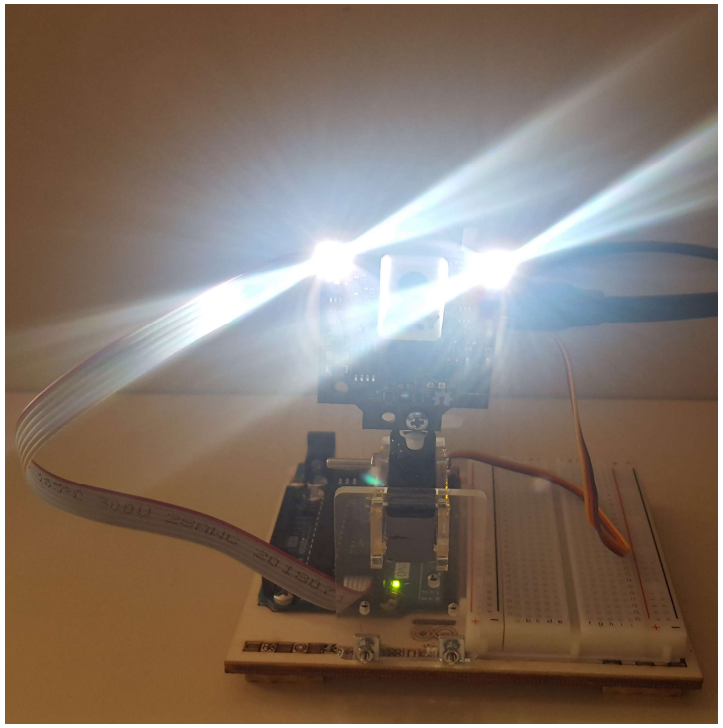


Lab: Teaching Pixy2 Camera for Object Recognition and Detection. . .

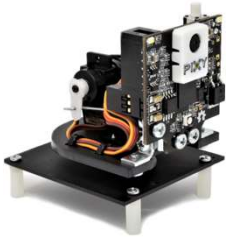


Toggling LED Lamps

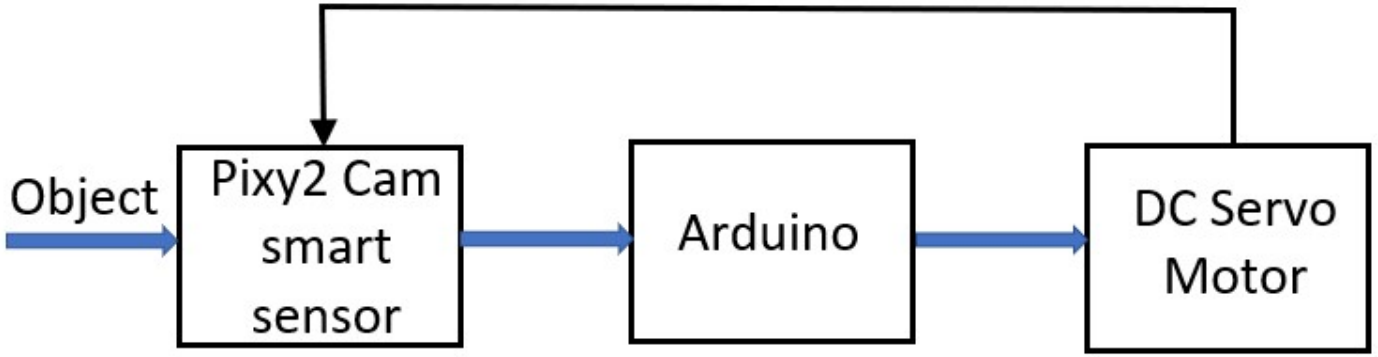




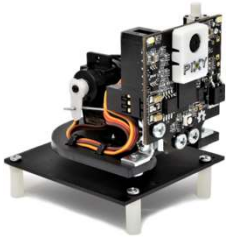
Lab: Teaching Pixy2 Camera for Object Recognition and Detection. . .



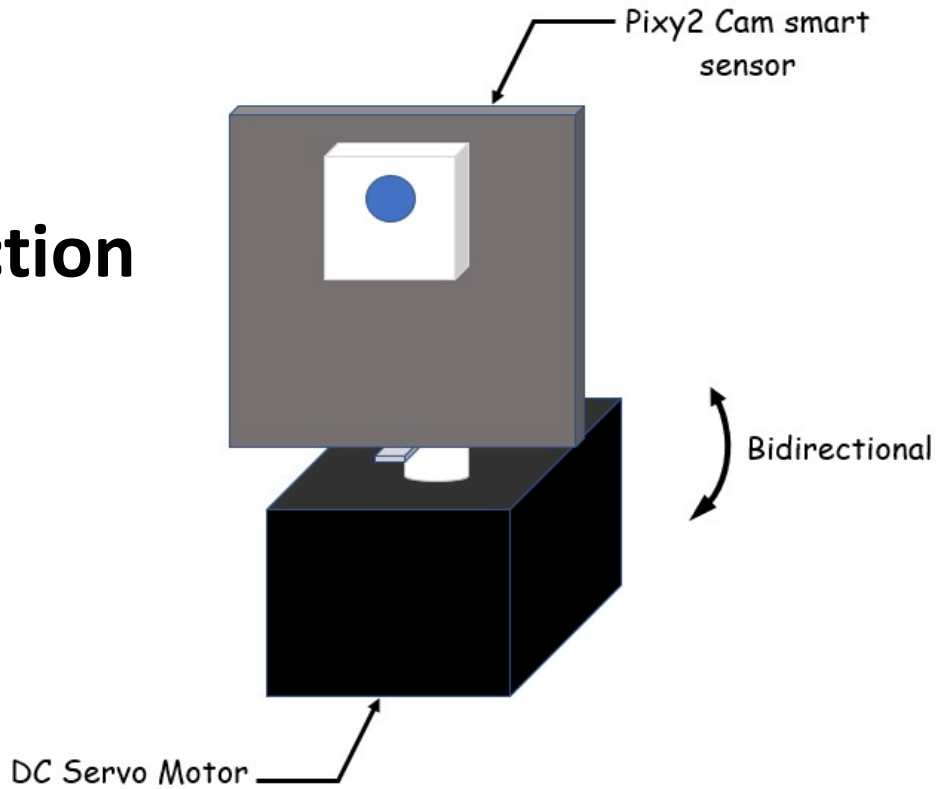
Pan Function: System Block Diagram



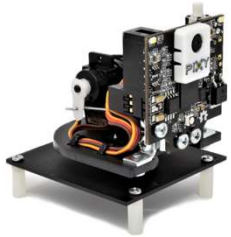
Lab: Teaching Pixy2 Camera for Object Recognition and Detection. . .



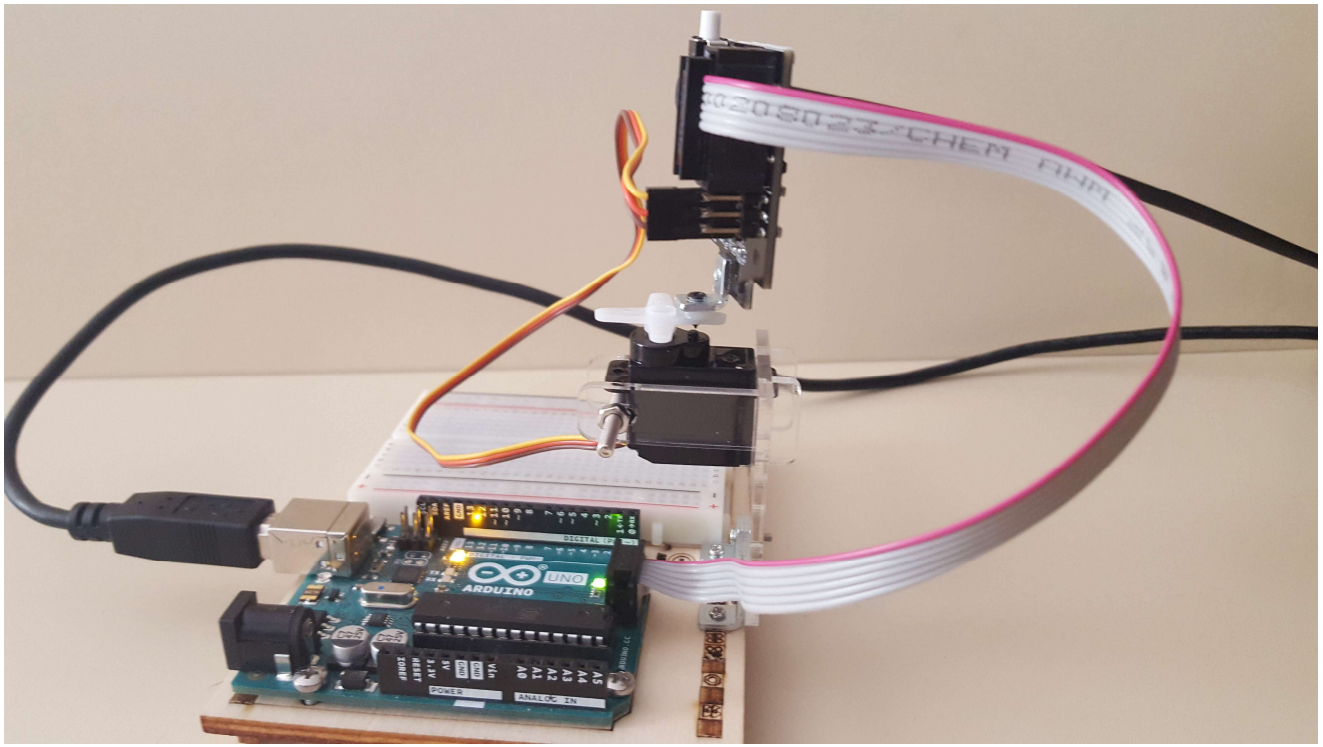
Pan Function



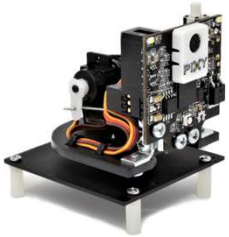
Lab: Teaching Pixy2 Camera for Object Recognition and Detection. . .

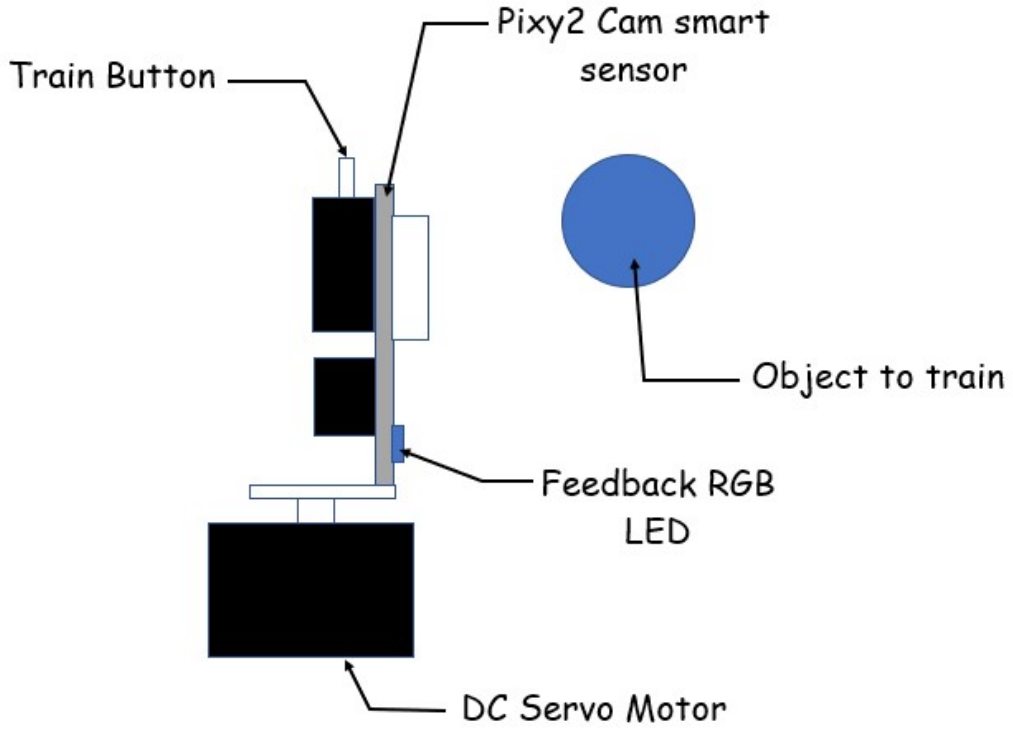


Pan Function



Lab: Teaching Pixy2 Camera for Object Recognition and Detection. . .





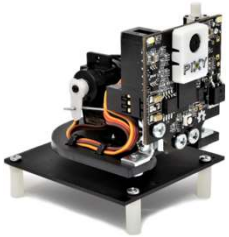
Question 4

Pixy2 Port Pins may control a DC brushless motor

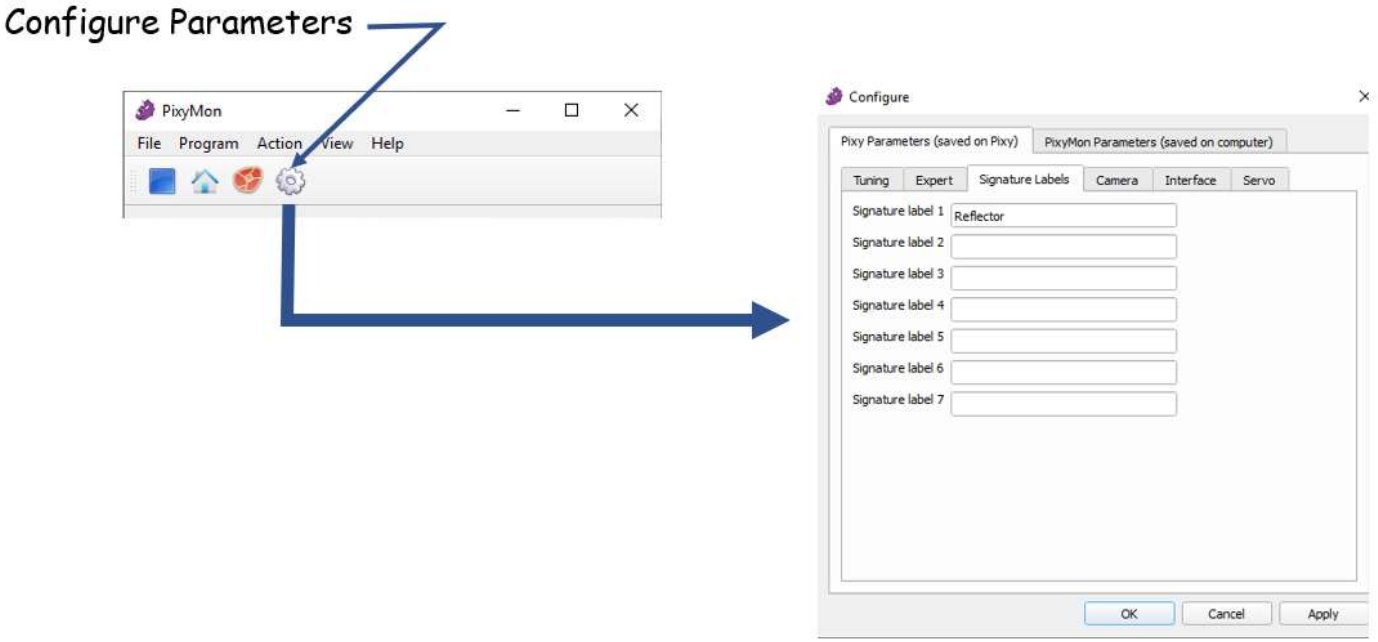
a) True

b) False

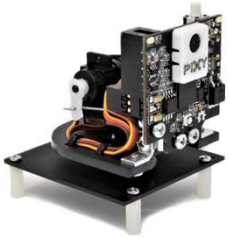
Lab: Teaching Pixy2 Camera for Object Recognition and Detection. . .



Defining a Signature Label

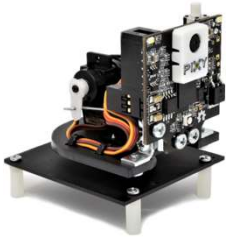


Lab: Teaching Pixy2 Camera for Object Recognition and Detection. . .



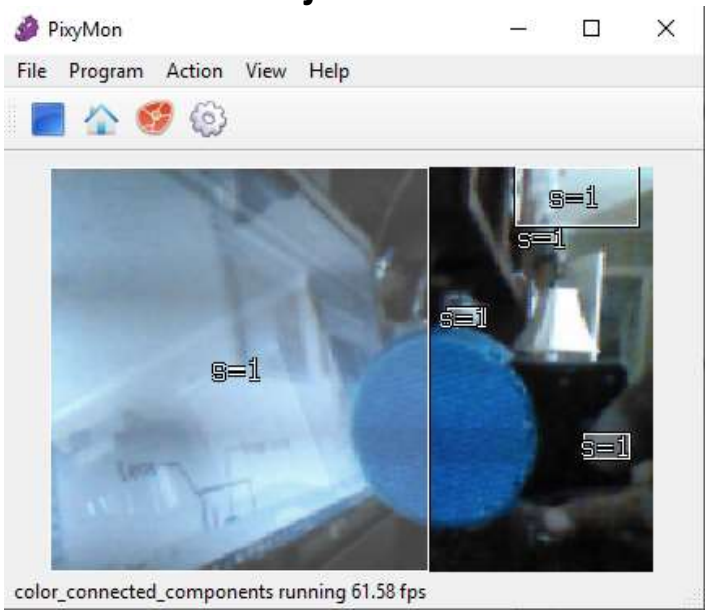
Object to Detect with Pixy2

Lab: Teaching Pixy2 Camera for Object Recognition and Detection. . .

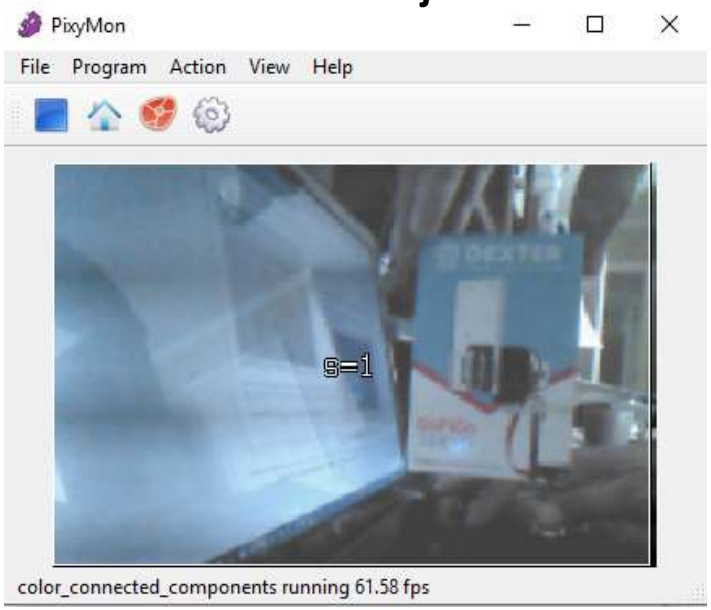


Training the Pixy2

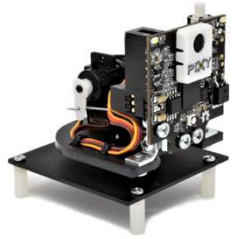
Trained Object Detected



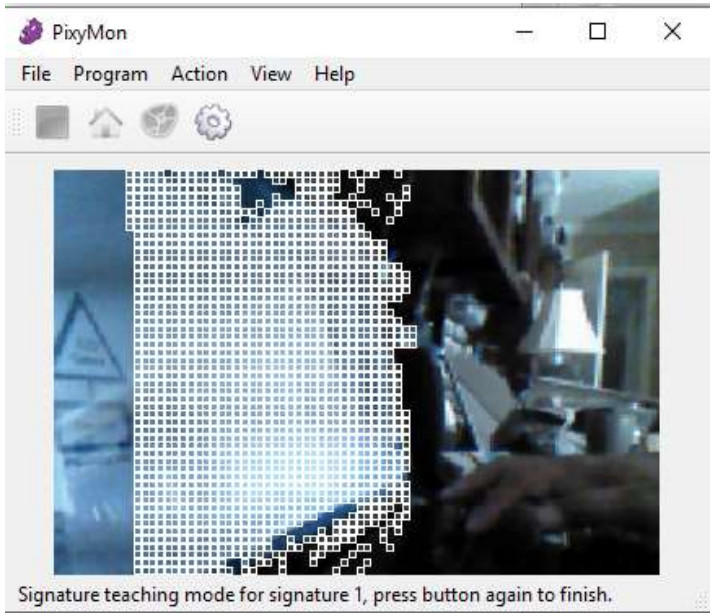
Non Trained Object

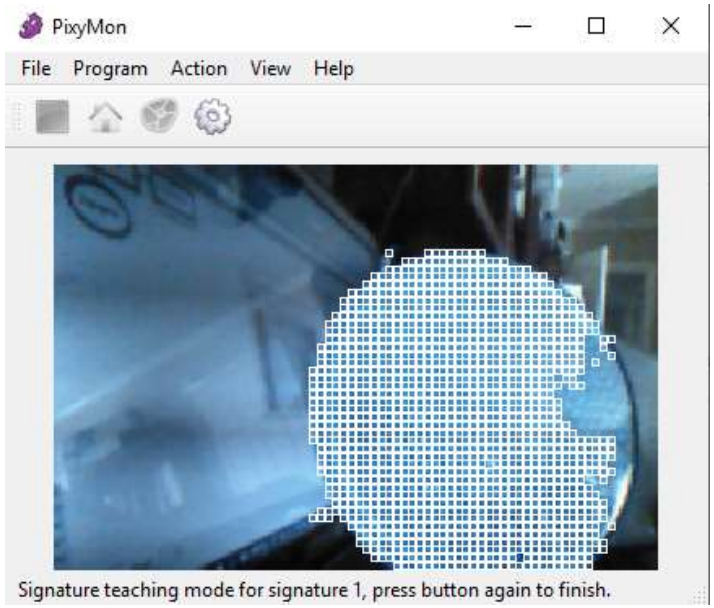


Lab: Teaching Pixy2 Camera for Object Recognition and Detection. . .

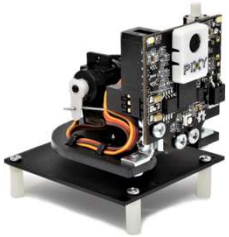


Training the Pixy2

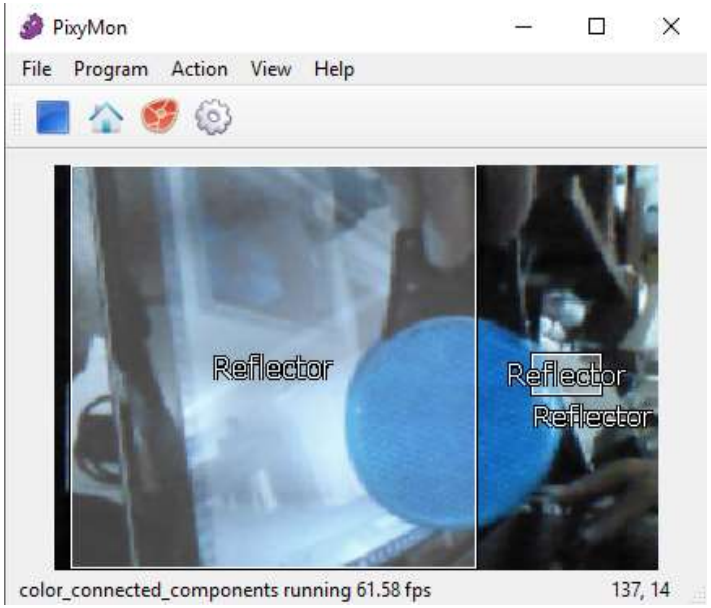


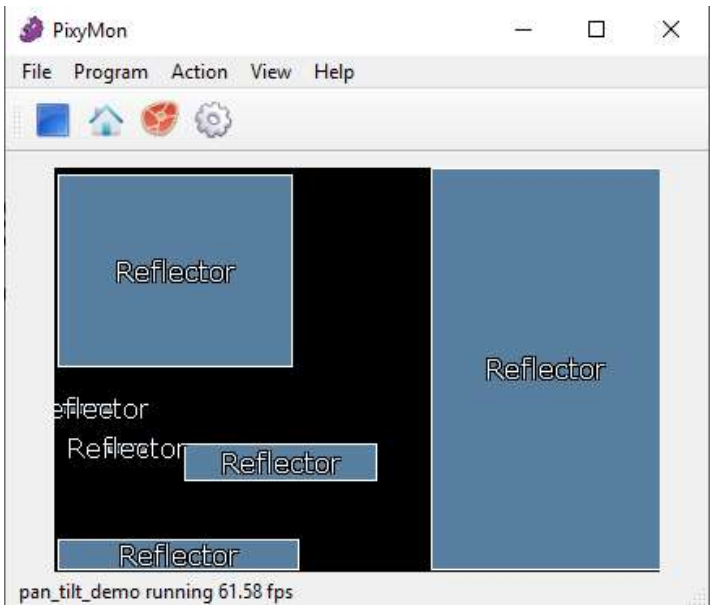


Lab: Teaching Pixy2 Camera for Object Recognition and Detection. . .

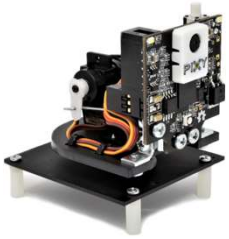


Training the Pixy2

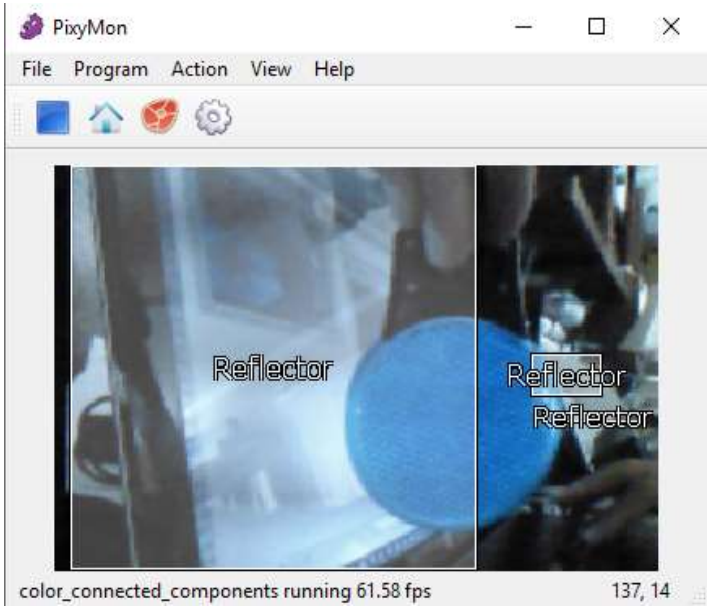


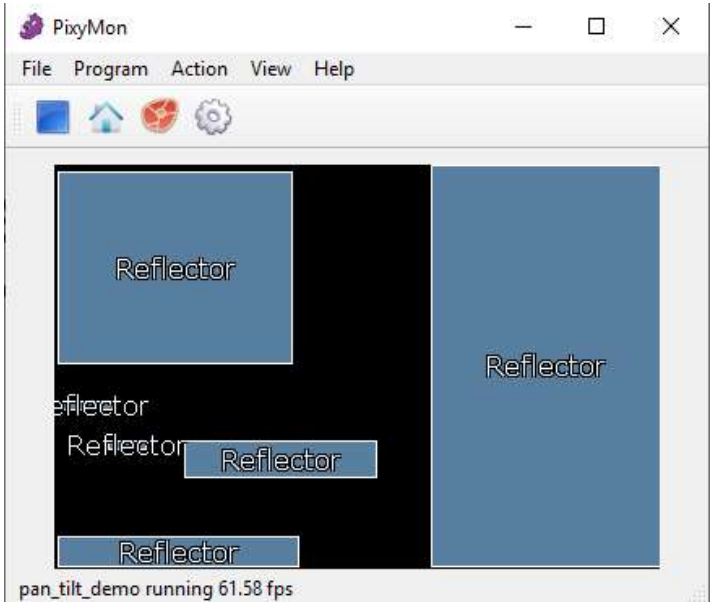


Lab: Teaching Pixy2 Camera for Object Recognition and Detection. . .

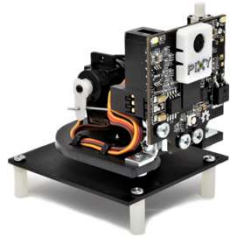


Pan Function

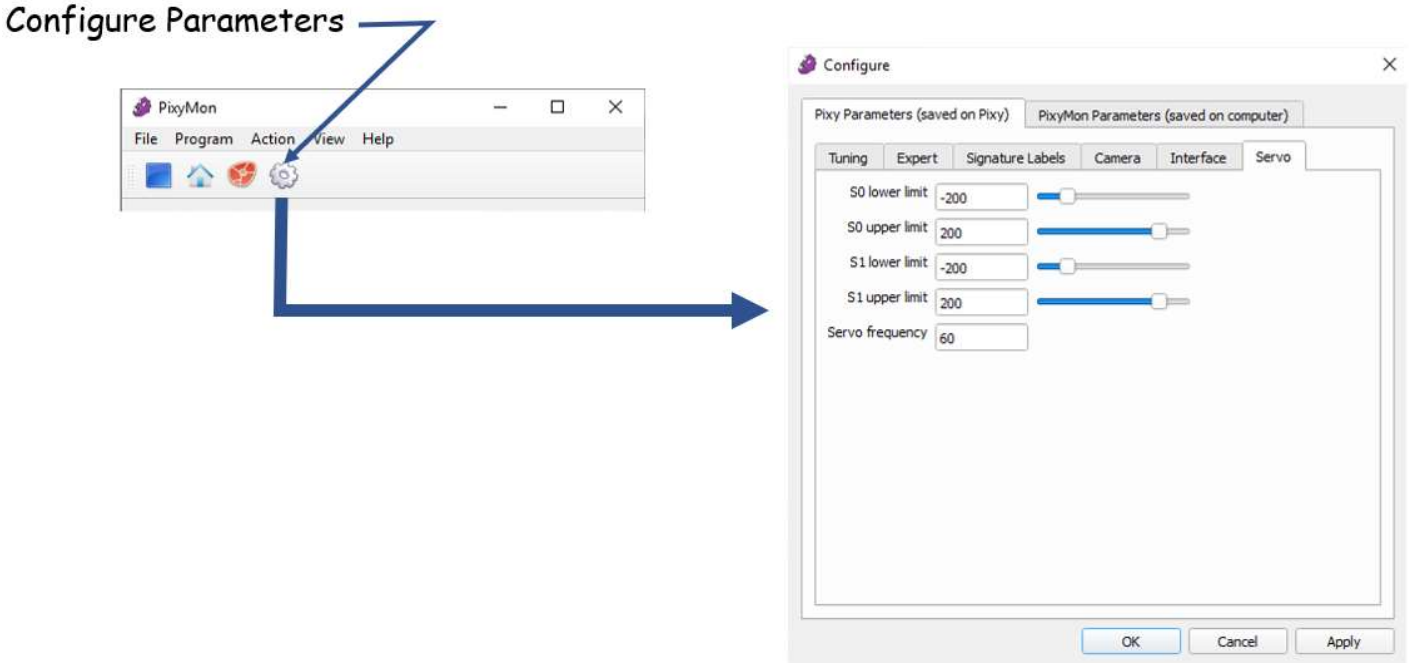




Lab: Teaching Pixy2 Camera for Object Recognition and Detection…



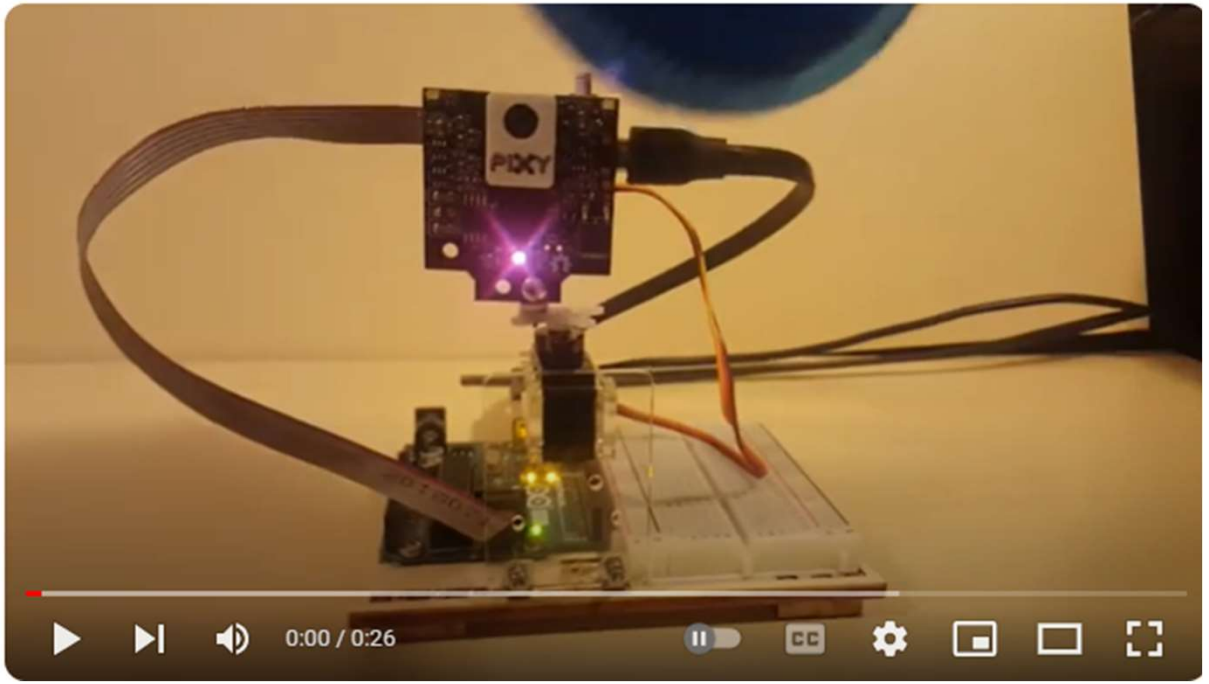
Adjusting Servo Motor Parameters



Lab: Teaching Pixy2 Camera for Object Recognition and Detection. . .

Watch YouTube Video to see the device in action!

https://youtu.be/E1KUd0McYqU



Question 5

Which PixyMon icon is used to adjust the DC servo motor parameters?

a) House
b) Film Reel
c) Gear
d) none of the above

Thank you for attending

Please consider the resources below:

Ben-Gal, I, Herer, Y. T., & Raz, T. (2002). Self-correcting inspection procedure under errors. *IIE Transactions, 34*, 529 – 540. https://www.academia.edu/12922699/Self-correcting_inspection_procedure_under_inspection_errors

Bozinovski, S. (2020). Reminder of the first paper on transfer learning in neural networks, 1976. *Informatics 44*, 291-302. https://www.researchgate.net/publication/346435488_Reminder_of_the_First_Paper_on_Transfer_Learning_in_Neural_Networks_1976

Chin, R.T., & Harlow, C. A. (1992). Automated visual inspection: A survey. IEEE Transactions On Pattern Analysis and Machine Intelligence, 4 (6), 557-573. https://ieeexplore.ieee.org/document/4767309

Gounaridou, A., Pantraki, E., Dimitriadis, A.T., Ioaannidis, D., & Tzovaras, D. (2023). Semi-automated visual quality control inspection during construction or renovation of railways using deep learning techniques and augmented reality visualization. *Proceedings of the 23rd International Conference On Construction Applications of Virtual Reality*, 865 -976. https://www.researchgate.net/publication/378535268_Semi-Automated_Visual_Quality_Control_Inspection_During_Construction_or_Renovation_of_Railways_Using_Deep_Learning_Techniques_and_Augmented_Reality_Visualization

Panella, F., Lucy, J., Fisk, E., Huang, S.T., & Loo, Y. (2023). Computer vision and machine learning for cost-effective automated visual inspection of tunnels: A case study. https://www.taylorfrancis.com/chapters/oa-edit/10.1201/9781003348030-340/computer-vision-machine-learning-cost-effective-fully-automated-visual-inspection-tunnels-case-study-panella-lucy-fisk-huang-loo

Thank you for attending

Please consider the resources below:

Rahimi, H.N., & Nazemizadeh, M. (2013). Dynamic analysis and intelligent control techniques for flexible manipulators: A review. *Advanced Robotics*, 1- 14. https://www.academia.edu/32830488/Dynamic_analysis_and_intelligent_control_techniques_for_flexible_manipulators_a_review

CEC Continuing Education Center

DesignNews

Thank You

Sponsored by

DigiKey

informa markets