CEC Continuing Education Center

DesignNews

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

# Introduction To The Pixy2 Camera: Part 2 (Automatic Tracking- Visual Inspection Device)

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# Webinar Logistics

- Turn on your system sound to hear the streaming presentation.
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- Participate in ‘Attendee Chat’ by maximizing the chat widget in your dock.

# Dr. Don Wilcher

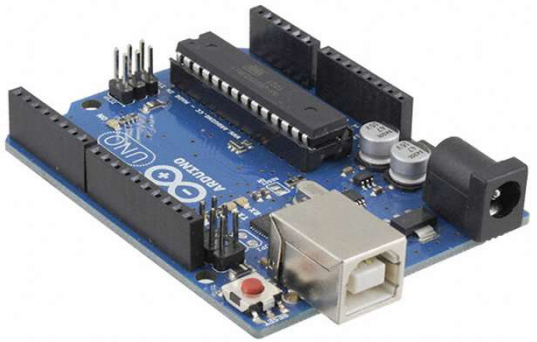
Visit ‘Lecturer Profile’ in your console for more details.

# 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**

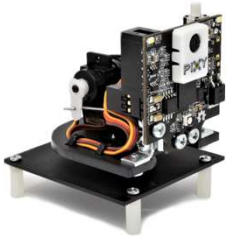
# Agenda:

- Review of Pan Mechanism Design Concept
- Mechanical Assembly of Pan-Tilt Servo Motor Kit
- Lab: Teaching Pixy2 Camera To Recognized and Track Objects

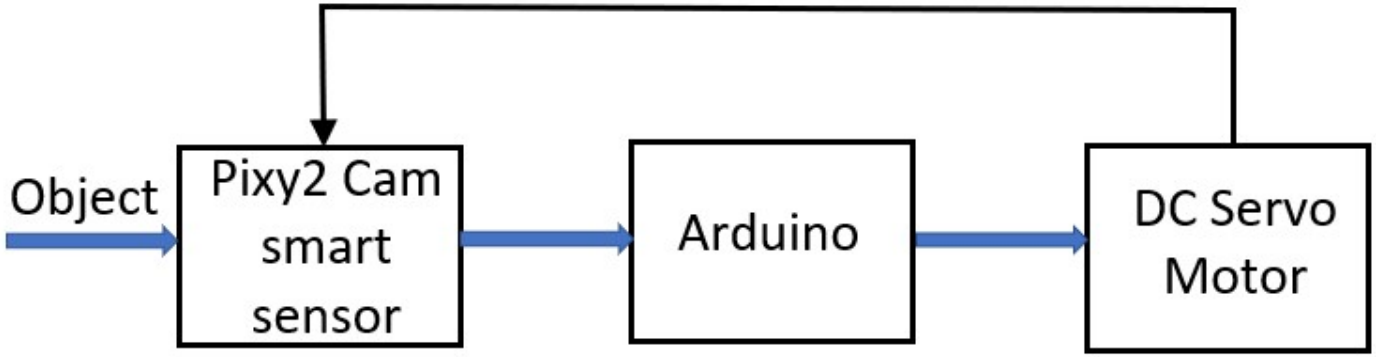
## Seminal Research Perspective

"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).

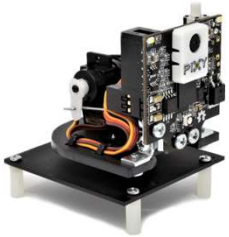
# Review of Pan Mechanism Design Concept



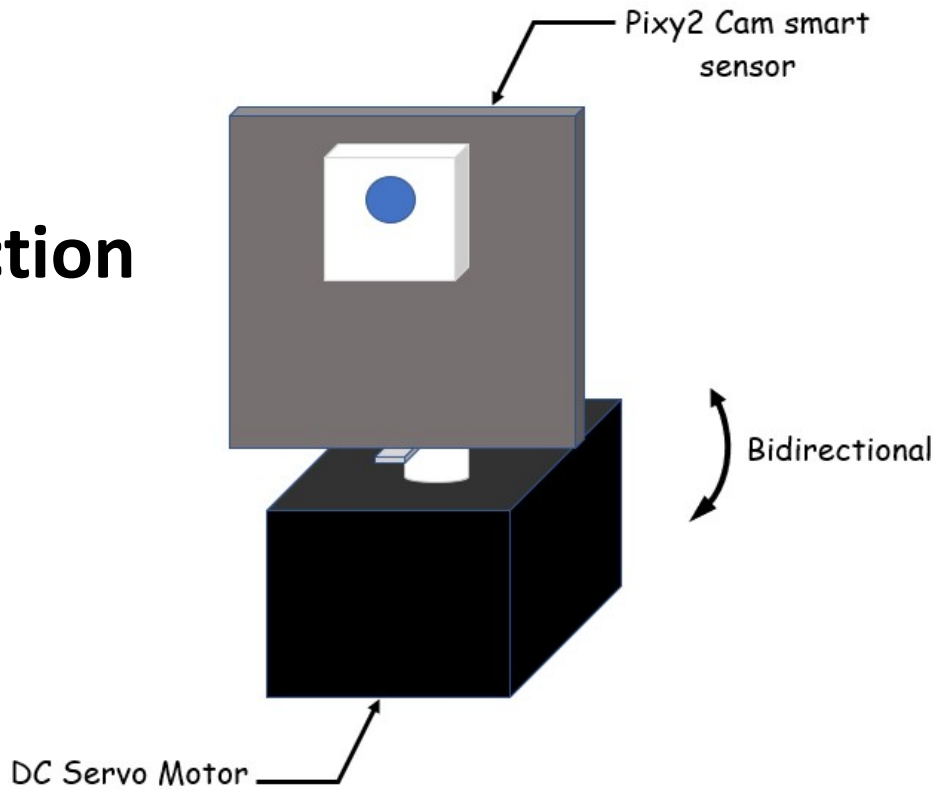
## Pan Function: System Block Diagram



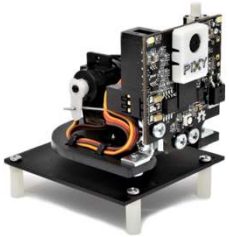
# Review of Pan Mechanism Design Concept. . .

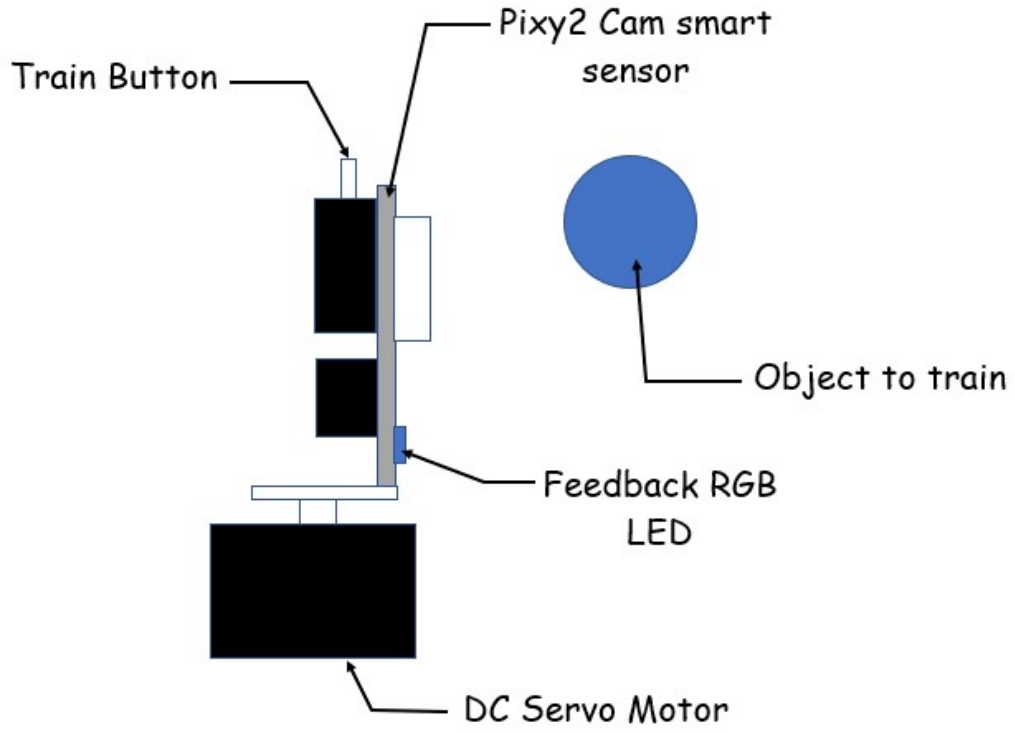


## Pan Function



# Review of Pan Mechanism Design Concept. . .



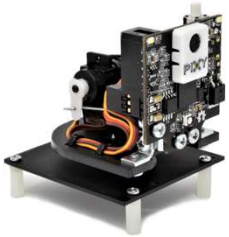


# Question 1

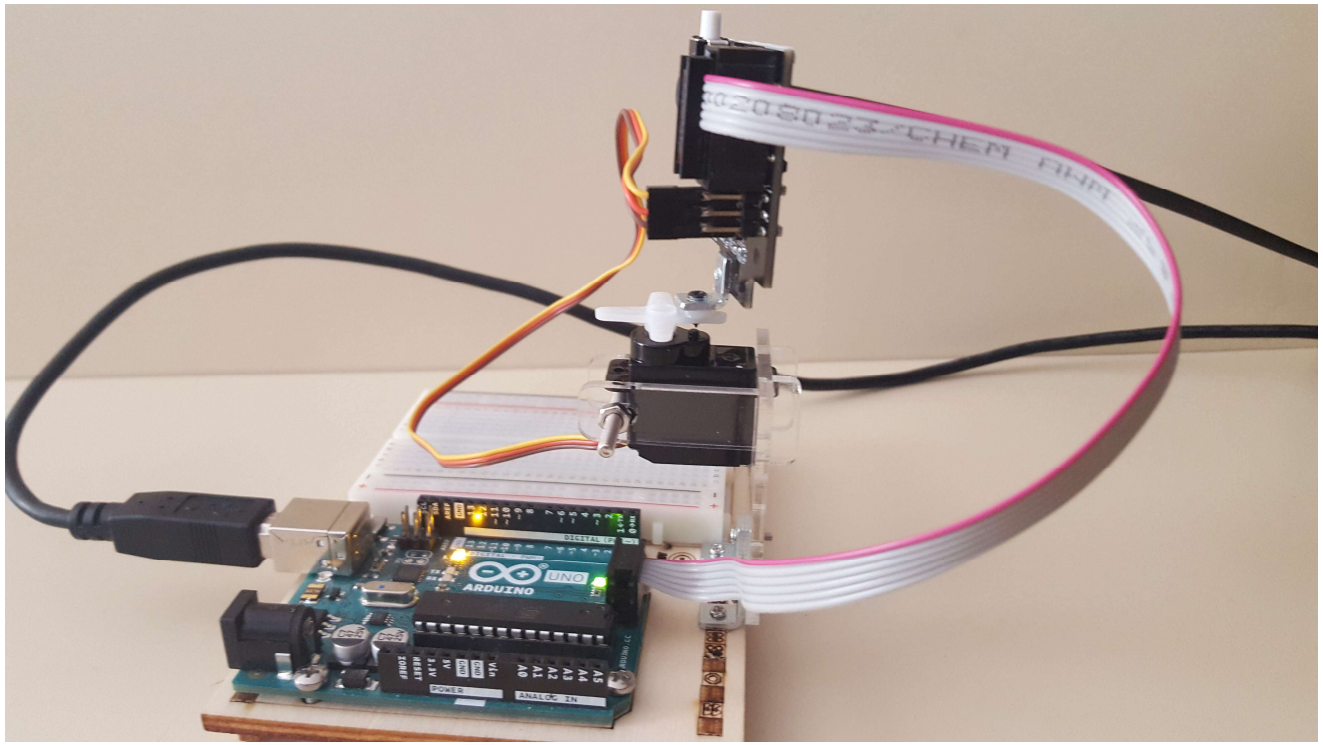
**In reviewing slide 7, what is required to initiate the Pan Function?**

**a) DC Servo Motor**
**b) Arduino**
**c) Pixy2 Cam Smart Sensor**
**d) object**

# Review of Pan Mechanism Design Concept. . .



## Pan Function



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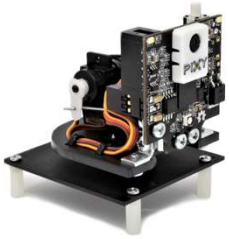
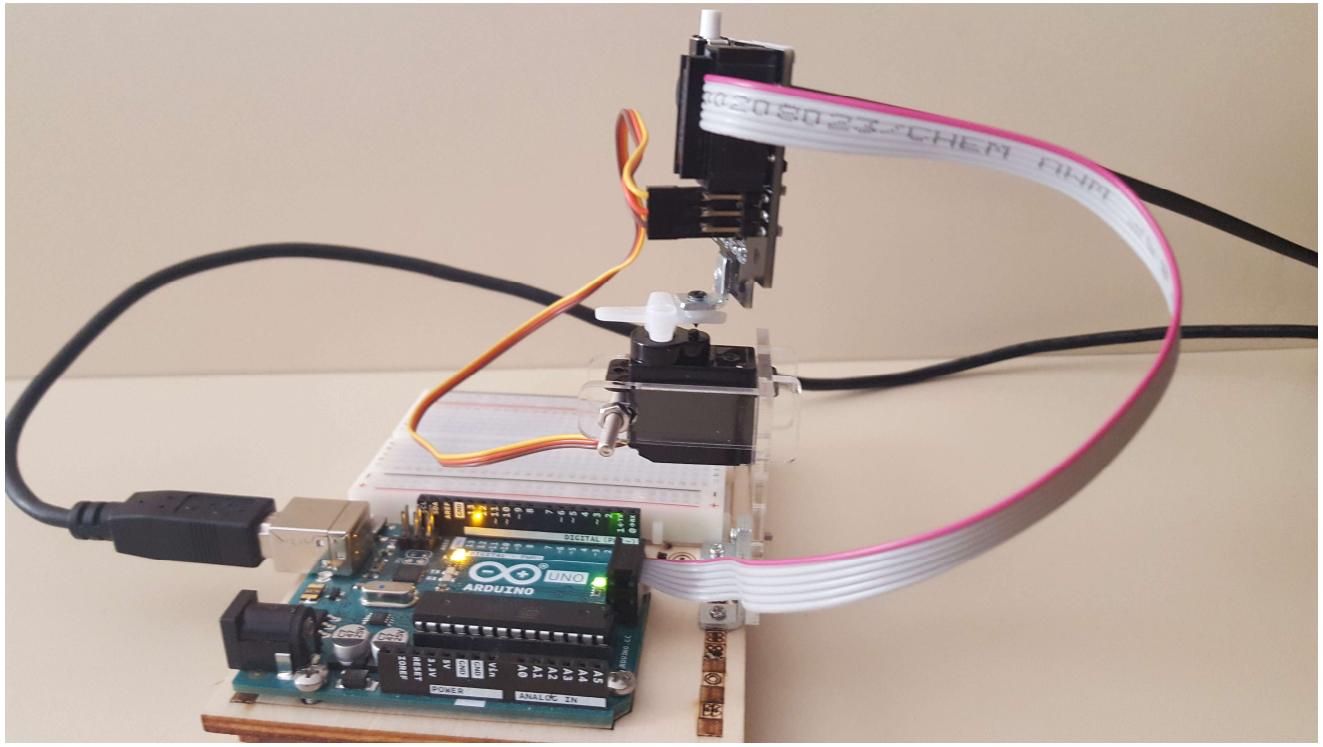
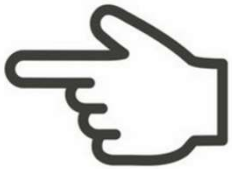
# Review of Pan Mechanism Design Concept. . .

## Pan Function






**GoPiGo Servo Kit used to Build Pan Mechanism**

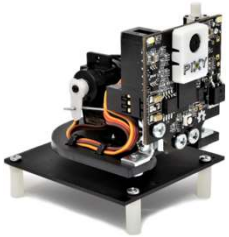


# Question 2

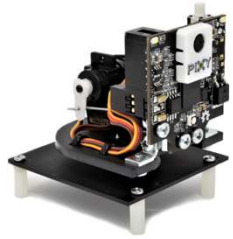
**What kit was used to build the prototype Pan Function mechanism?**

**a) GoPro**
**b) Go SERVO Pi Go**
**c) GoPiGo**
**d) GoPiGo SERVO**

# Mechanical Assembly of Pan-Tilt Servo Motor Kit



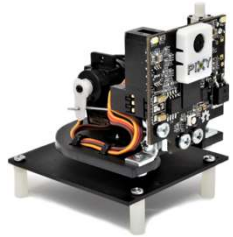
# Mechanical Assembly of Pan-Tilt Servo Motor Kit. . .



Assembly Technical Notes:

- The following images highlight key aspects of assembly
- Have additional appropriate size tie-straps.
- Have a spare servo motor
- Fasteners and brackets are small
- Have a spare box of small screws (appropriate size screws may be missing from the kit)
- Will have to loosen and realign Pixy2 Camera bracket to ensure Tilt servo motor will move Pixy2 Camera appropriately (no binding).
- Have patience in the assembly process
- Have fun assembling the Pan/Tilt Servo Motor mechanism

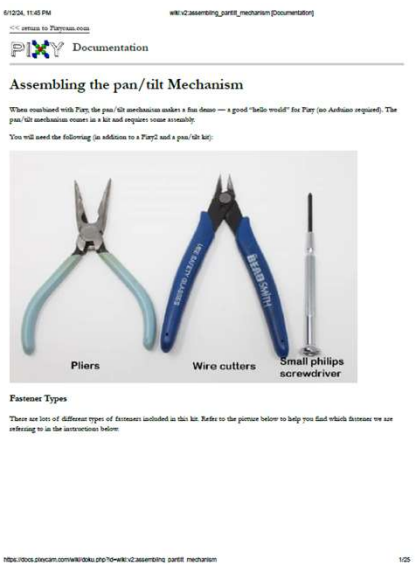
# Mechanical Assembly of Pan-Tilt Servo Motor Kit. . .



Notes:

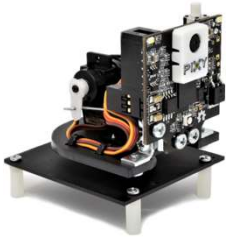
For additional details and a description of the Pan/Tilt Servo Motor mechanism assembly, refer to the link at the bottom of the slide deck.

**Reference Online Assembly wiki for assembly support**

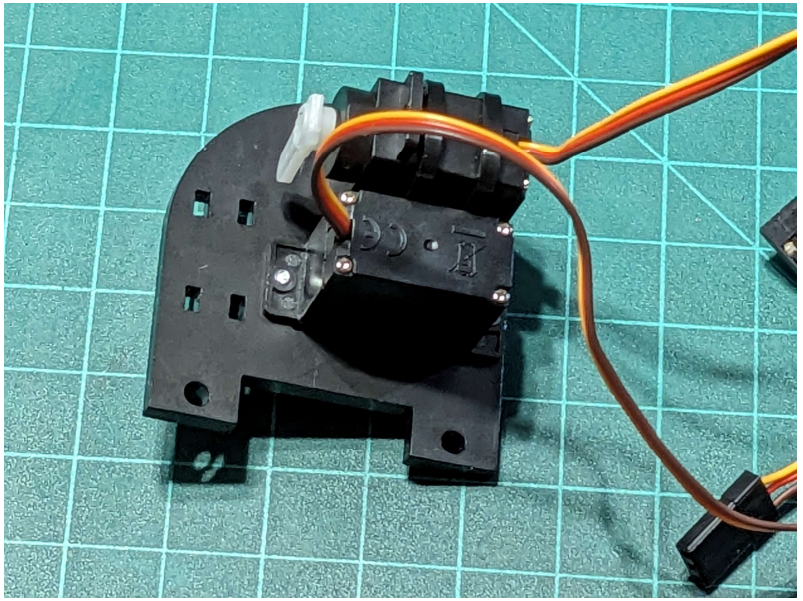



https://docs.pixycam.com/wiki/doku.php?id=wiki:v2:assembling_pantilt_mechanism

# Mechanical Assembly of Pan-Tilt Servo Motor Kit. . .



Cut Cross Servo Horn

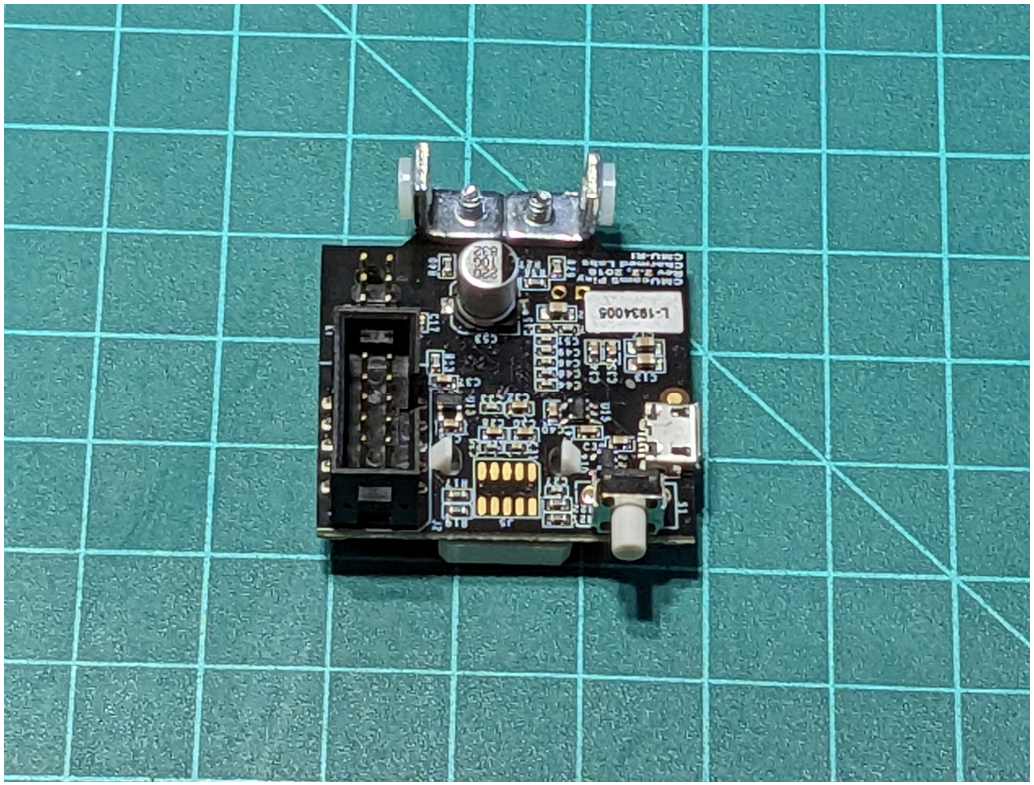


Mount Tilt and Pan Servo Motors onto the Mounting Plate. Secure the Tilt Servo Motor with Tie-Straps. Secure the Pan Servo Motor with fasteners.

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

# Mechanical Assembly of Pan/Tilt Sevo Motor Kit. . .

Attach small right-angle brackets to Pixy 2 Camera



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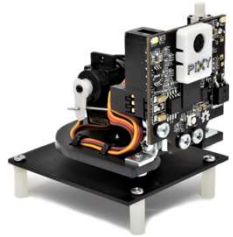
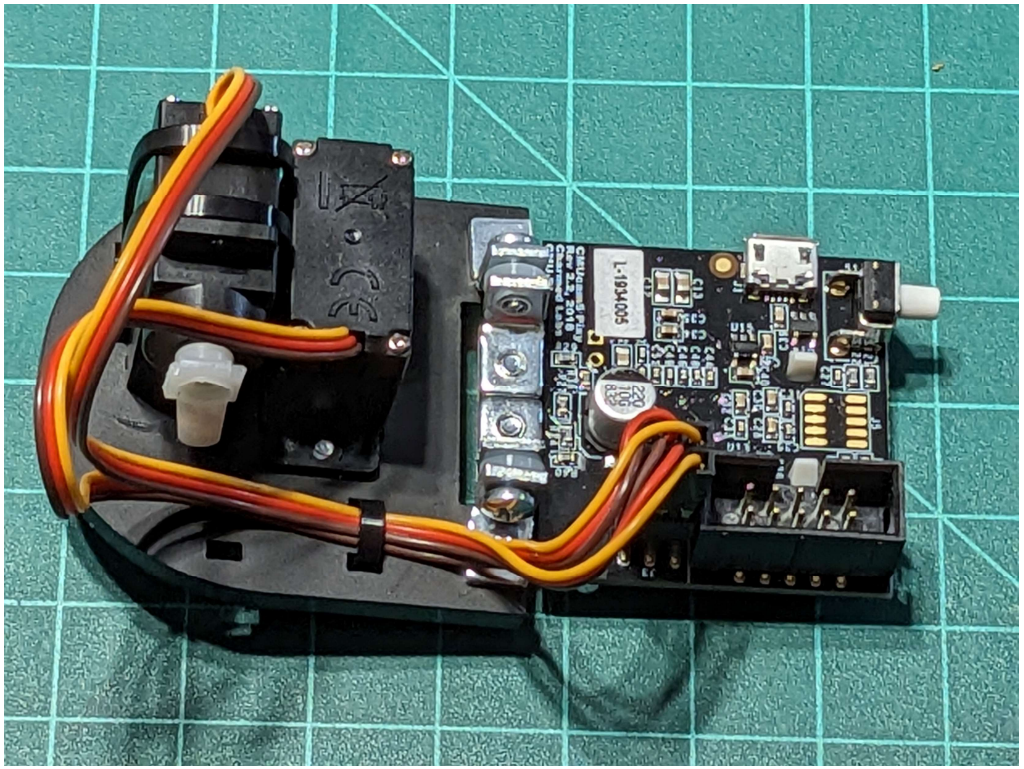
# Mechanical Assembly of Pan-Tilt Servo Motor Kit. . .



Attach Pixy2 Camera to Tilt and Pan Servo Motor Mounting plate using fasteners.



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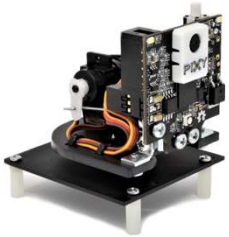
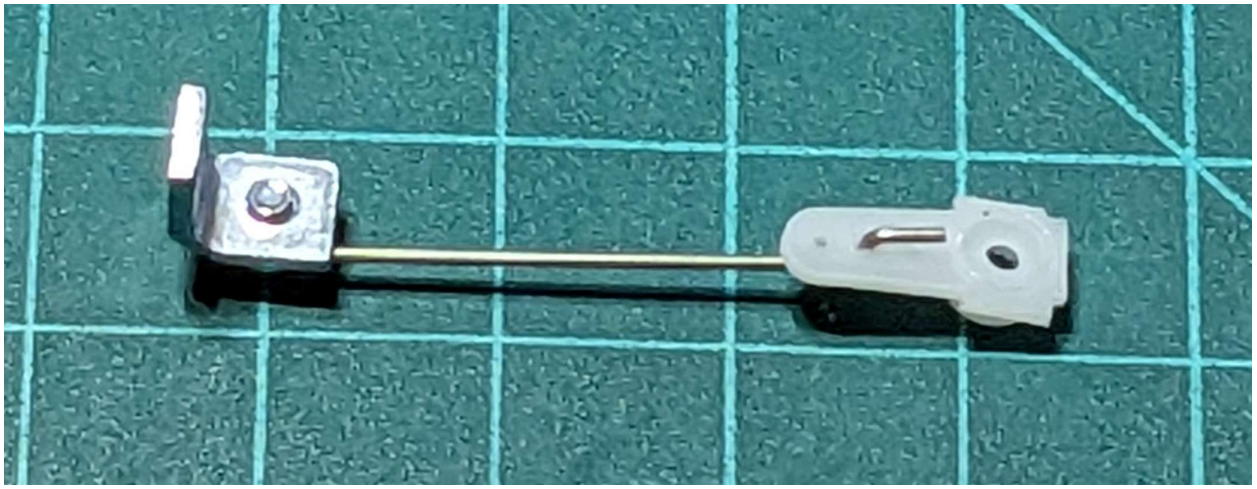
# Mechanical Assembly of Pan/Tilt Sevo Motor Kit. . .



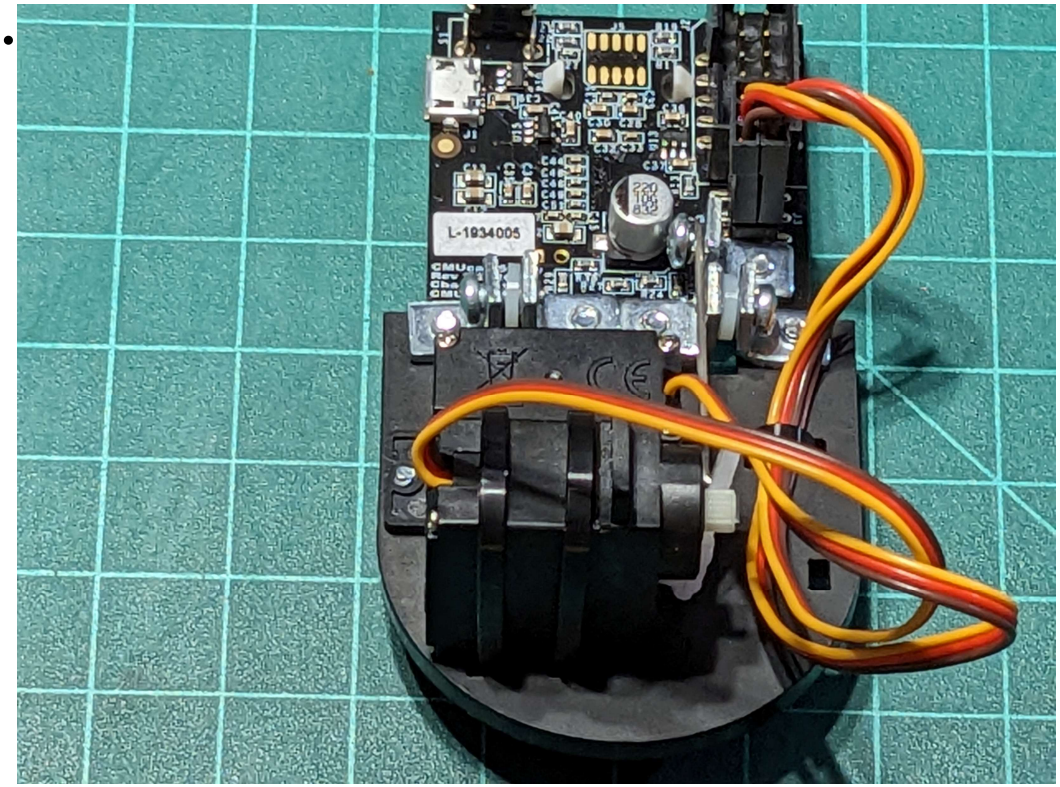
Attach the Tilt Servo Motor Push rod to the cut cross servo motor horn.



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

# Mechanical Assembly of Pan-Tilt Servo Motor Kit. . .

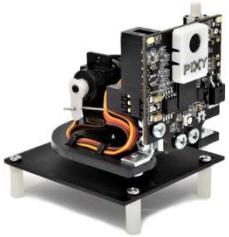
Attach the Push rod assembly to the Pixy2 Camera using a small right-angle bracket and a fastener. Attach the cut cross horn to the Tilt Servo Motor.



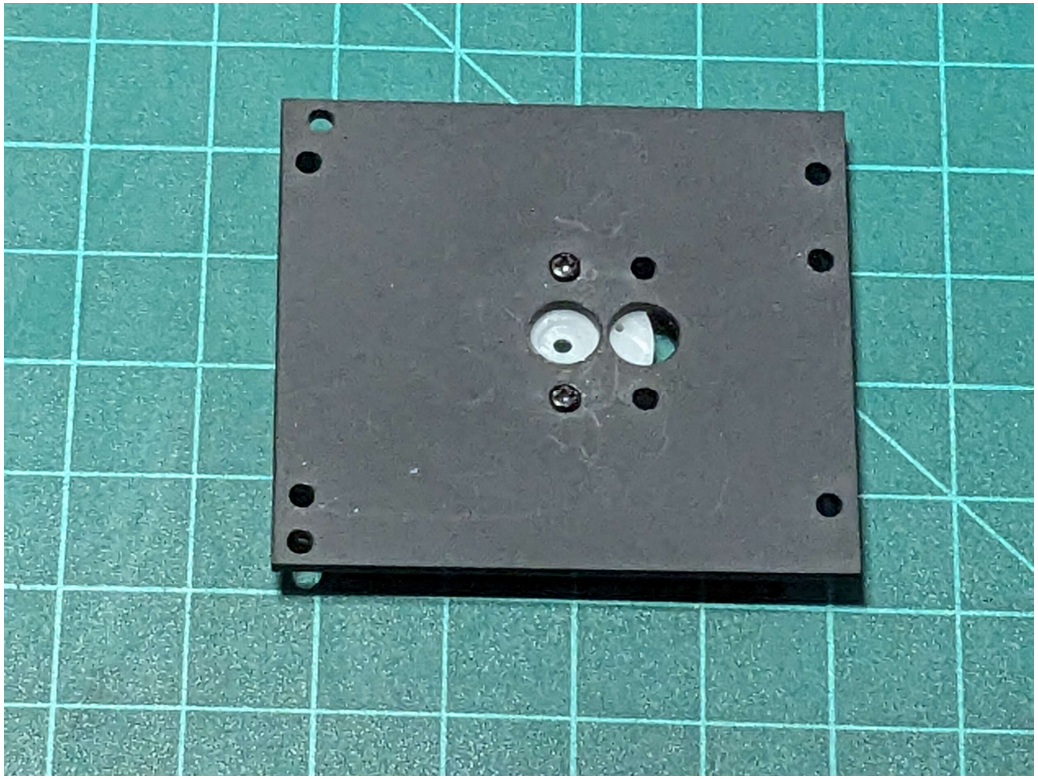

Attach the Tilt Servo Motor connector to the 3-pin male connector on the left side. The silver connectors will be facing right.
Attach the Pan Motor connector to the 3-pin male connector on the right side. The silver connectors will be facing right.

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

# Mechanical Assembly of Pan-Tilt Servo Motor Kit. . .



Attach the round servo motor horn to the Pan mounting using small fasteners.



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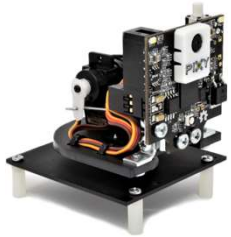
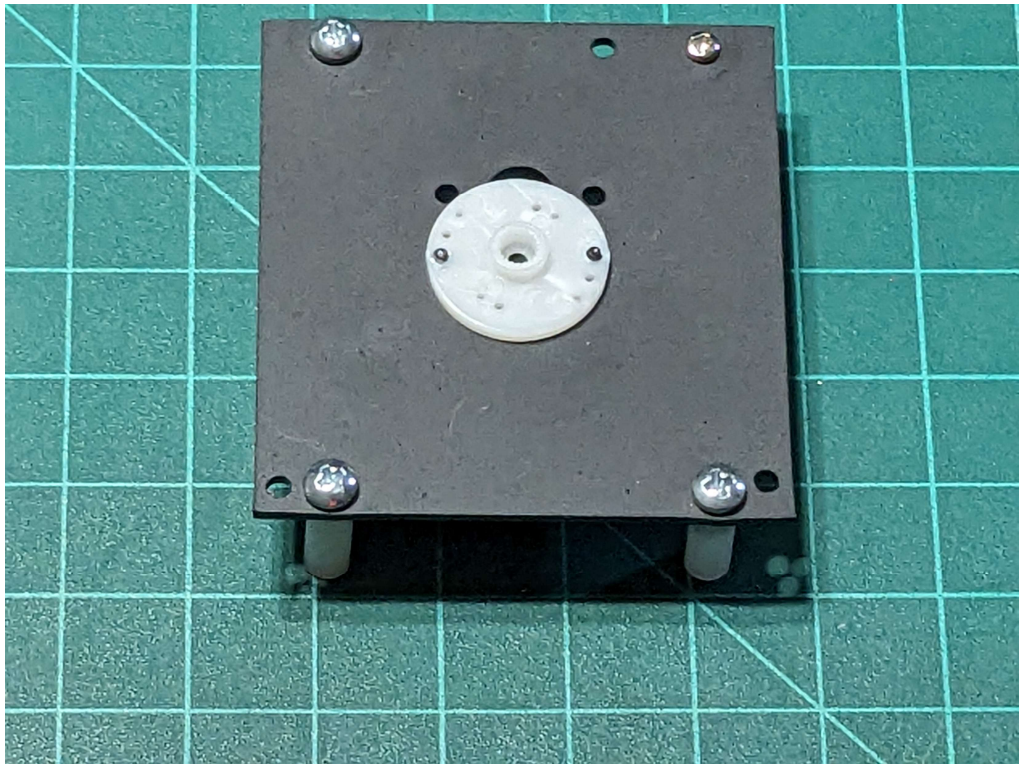
# Mechanical Assembly of Pan-Tilt Servo Motor Kit. . .



Flip the Pan mounting plate over. Attach 4-nylon stand-offs to the mounting plate using 4 fasteners



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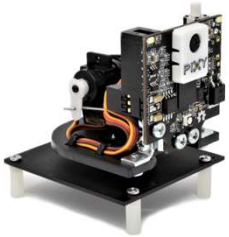
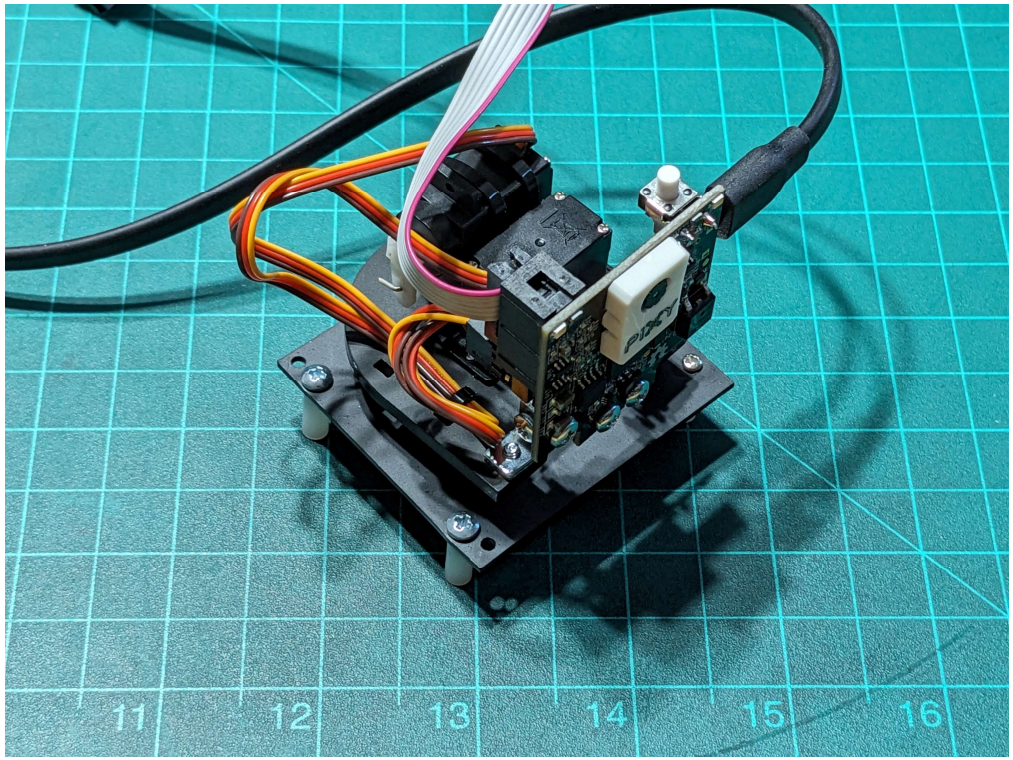
# Mechanical Assembly of Pan/Tilt Sevo Motor Kit. . .



The Pan-Tilt Servo Motor mechanism is assembled and ready for testing.




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

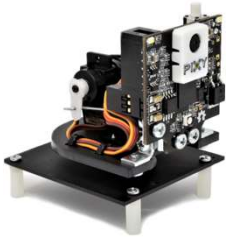
# Question 3

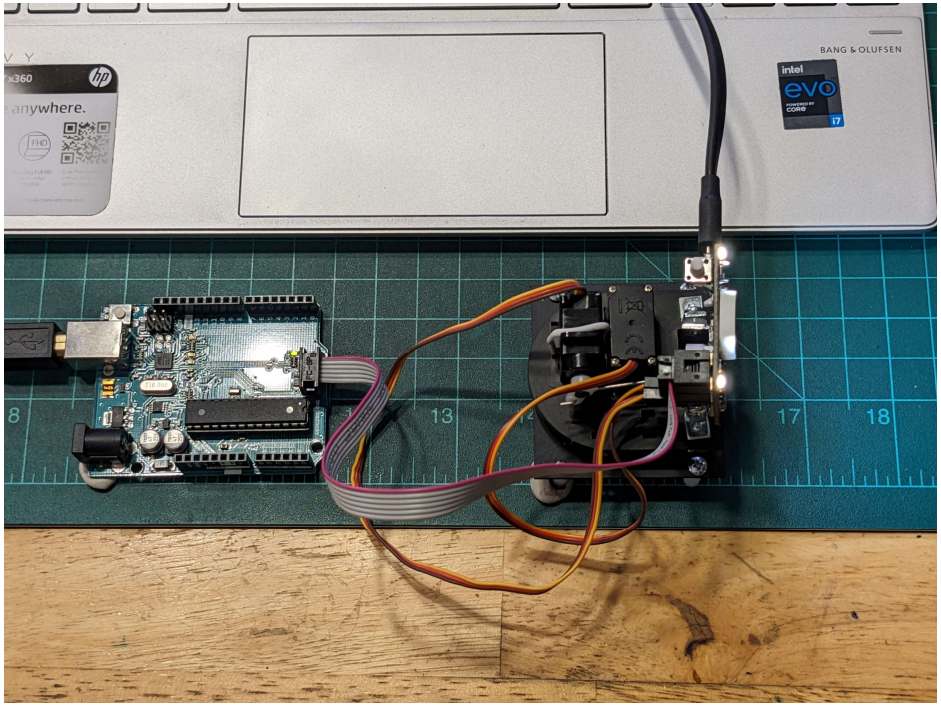
**When assembling the Pan-Tilt Servo Motor mechanism, having patience is not required?**

**a) False**

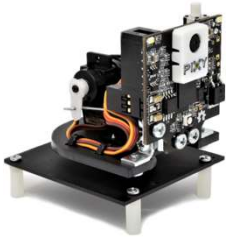
**b) True**

# Lab: Teaching Pixy2 Camera To Recognize and Track Objects





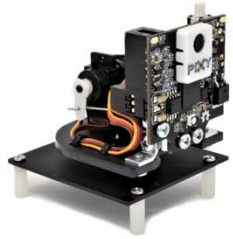
# Lab: Teaching Pixy2 Camera To Recognize and Track Objects. . .



**Lab Objectives:**

- Participants will learn to connect the Pixy2 Camera to the PixyMon2 software tool.
- Participants will learn to connect with the Pixy2 Camera.
- Participants will learn to train the Pixy2 Camera to detect an object.
- Participants will learn to tune the Pan and Tilt parameters of the Pixy Mon 2 Configuration Settings.
- Participants will learn to automate object detection using the Pan-Tilt Demo program.

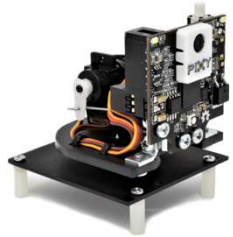
# Lab: Teaching Pixy2 Camera To Recognize and Track Objects. . .



Automated Visual Inspection System will recognize and track an orange container cap!

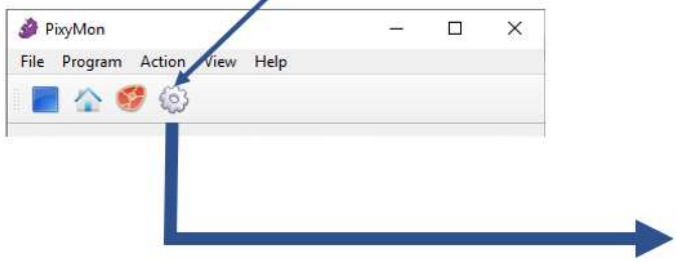
Concept Block Diagram

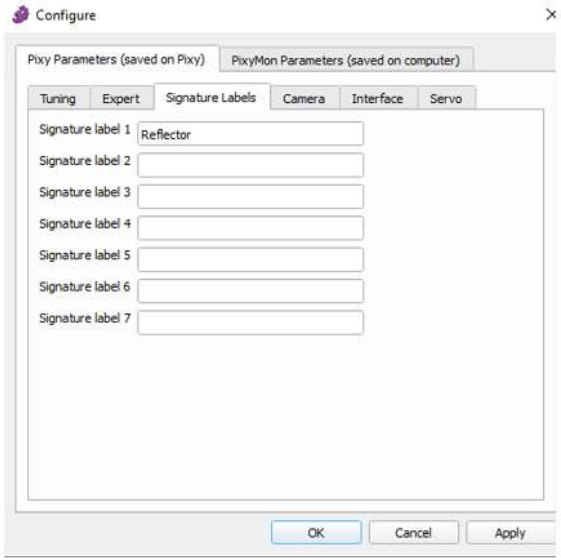
# Lab: Teaching Pixy2 Camera To Recognize and Track Objects. . .



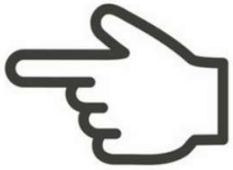
## Editing a Signature Label

Configure Parameters




Edit Signature 1 with Orange Cap



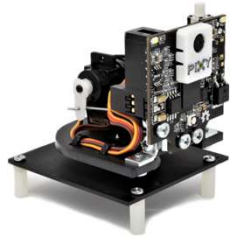
# Question 4

**The House Icon is used to configure the servo mechanism Pan-Tilt parameters.**

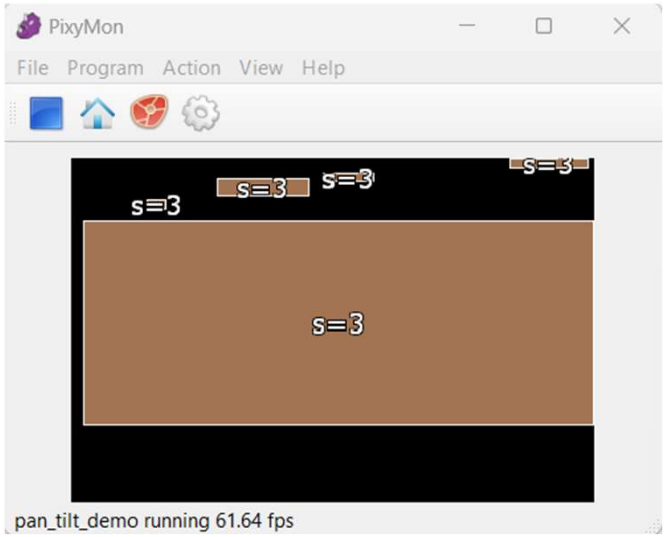
**a) True**

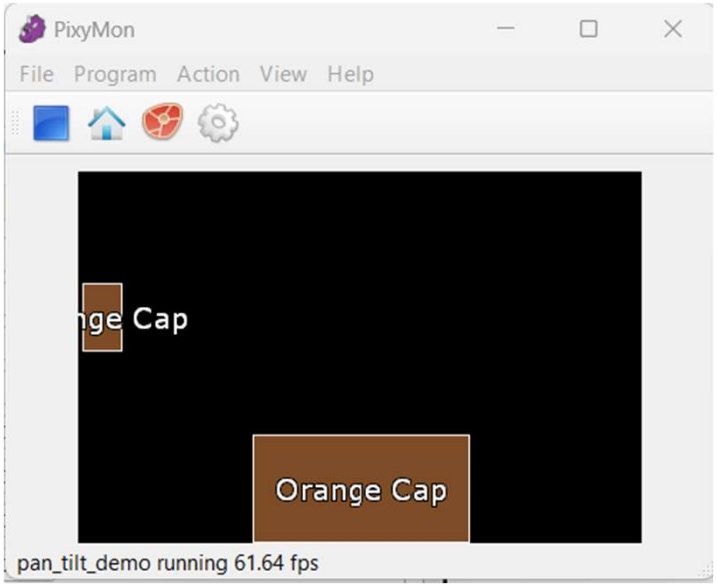
**b) False**

# Lab: Teaching Pixy2 Camera To Recognize and Track Objects. . .



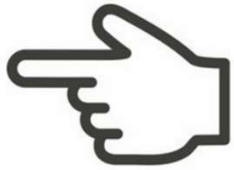
## Editing a Signature Label

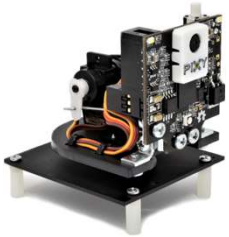



Orange Cap detected

Edit Signature 1 with Orange Cap

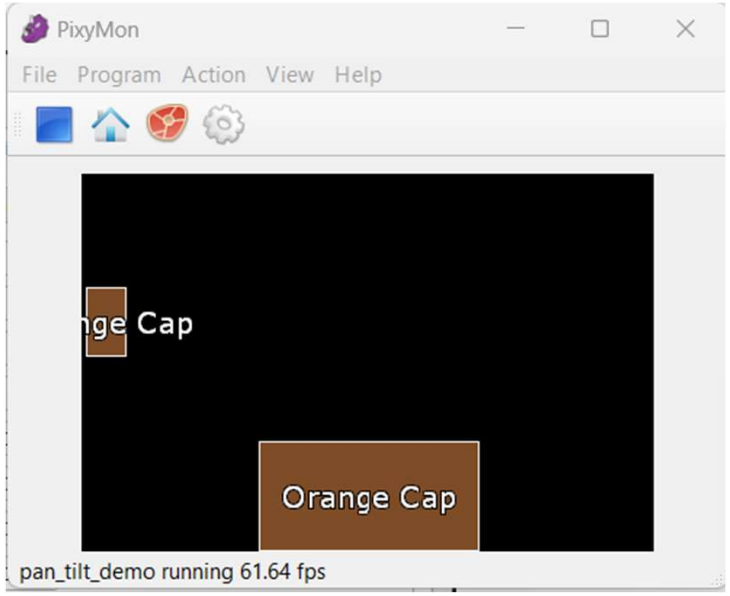


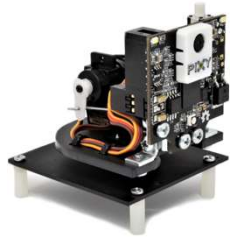


# Lab: Teaching Pixy2 Camera To Recognize and Track Objects. . .

## Running the Pan-Tilt Demo program

The demo (or any other program) anytime by selecting it in the Program menu. In particular, select Program➜pan_tilt_demo.

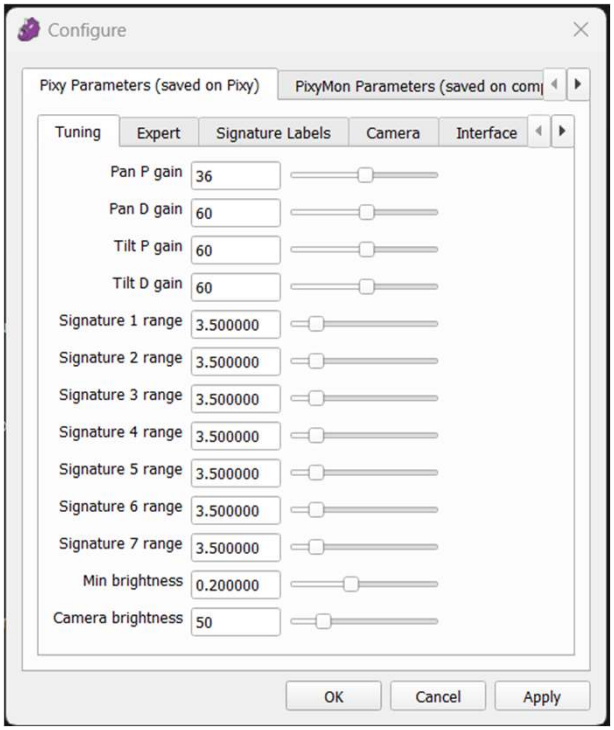




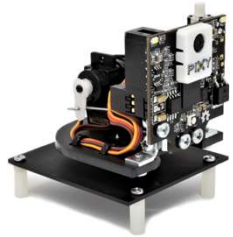
## Lab: Teaching Pixy2 Camera To Recognize and Track Objects. . .

# Configuring the Tracking Settings for the Pan-Tilt Mechanism

Experimentation of the Pan and Tilt P and D gain slider controls requires appropriate object tracking motion.

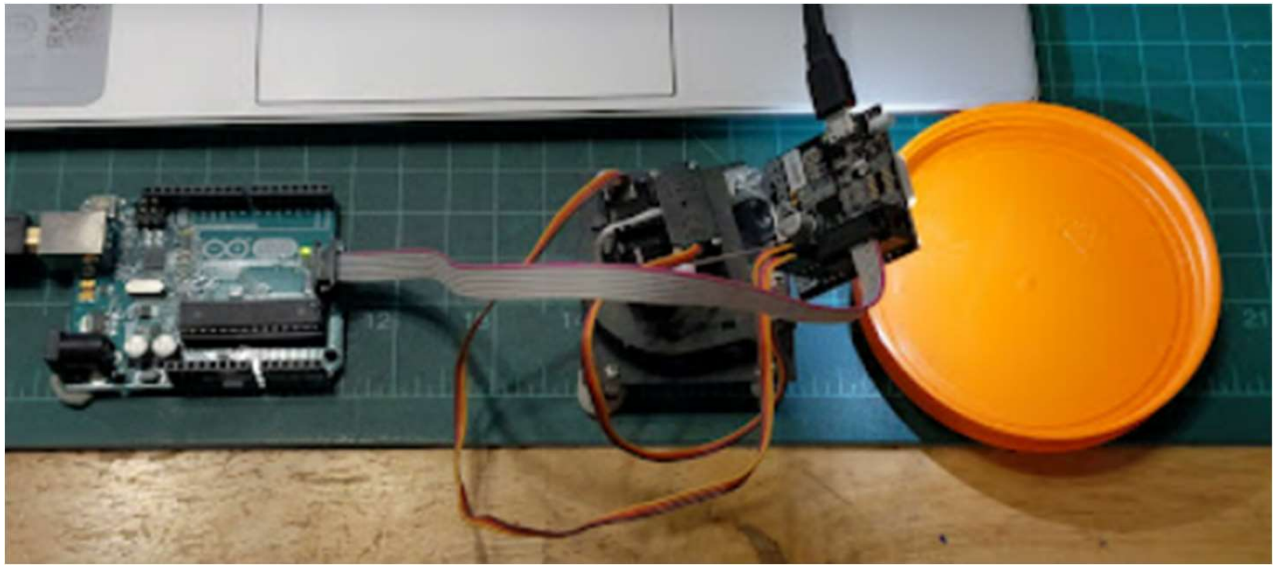


# Lab: Teaching Pixy2 Camera To Recognize and Track Objects. . .



## Toggling LED Lamps

Turning on the LED Lamps helps in object detection while tracking its movement.

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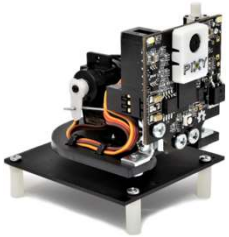
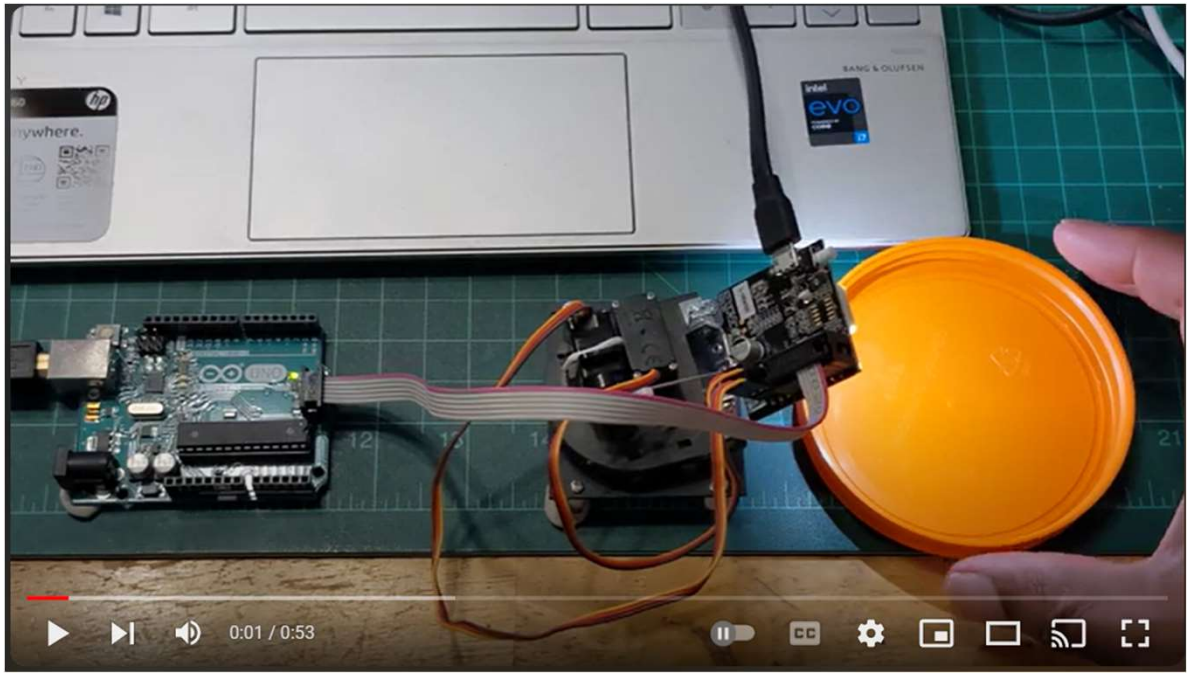


Watch YouTube Video to see the device in action!




https://www.youtube.com/watch?v=gBvHit7MDZI

# Question 5

**What 2 parameters are used to adjust the Pan/Tilt Servo Motor mechanism's movement?**

**a) P&T**
**b) P&C**
**c) P&A**
**d) P&D**

# 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

Pan-Tilt Demo Setup:

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

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