MET-2260: INFRARED ROBOTIC VISION

Cuyahoga Community College

Viewing: MET-2260 : Infrared Robotic Vision

Board of Trustees:
June 2023

Academic Term:
Fall 2023

Subject Code
MET - Mech Eng/Manuf Ind Eng Tech

Course Number:
2260

Title:
Infrared Robotic Vision

Catalog Description:
Course provides preparation to sit for the robotic infrared vision industry certification test. Covers vision system components, programming, error recovery, and inspection process. Also includes setup of a 2D or 3D Single view process a vision system.

Credit Hour(s):
3

Lecture Hour(s):
2

Lab Hour(s):
3

Requisites

Prerequisite and Corequisite
MET-2250 Robotics Operations Certification or departmental approval.

Outcomes

Course Outcome(s):
Establish robot-to-computer communication.

Objective(s):

a. Identify all components involving robot-to-computer communication.
b. View and/or change parameters in the robot and computer to facilitate communication.
c. Test communication.
d. Access the robot's web page in order to setup vision.
e. Check and/or change the robot IP address.
f. Check and/or change the computer IP address.
g. Ping devices to ensure good communication.
h. Access robot web page.
i. Use robot web page to access vision setup screen.

Course Outcome(s):
Perform Error Recovery.

Objective(s):

a. Check for impediments to servo power-up.
b. Remove impediments to servo power-up.

Course Outcome(s):

Create a Frame.

Objective(s):

a. Create tool frame for robot applicator.
b. Create user frames necessary for use with vision system.
c. Program and use a Tool frame.
d. Program a User frame to use as an offset frame.
e. Program a User frame using the calibration grid.

Course Outcome(s):

Setup an Inspection process.

Objective(s):

a. Setup the camera.
b. Train the vision system to recognize the part.
c. Program the robot for vision interface and part handling.
d. Setup the criteria upon which judgement will be made.

Course Outcome(s):

Setup 2D or 3D Single View process (Class Dependent).

Objective(s):

a. Setup the camera.
b. Calibrate the camera.
c. Setup the vision process.
d. Program the robot to respond to vision results.

Methods of Evaluation:

1. Tests/quizzes,
2. Laboratory experiments/tasks
3. Homework

Course Content Outline:

a. A. Robot-to-computer communication
    i. Components
    ii. Robot and computer parameters for communication
    iii. How to test communication
    iv. How to access the robot web page in order to set up vision
        1. Access Vision set up screen
        2. Perform setup of Vision
    v. How to check and/or change the robot IP address
    vi. How to check and/or change the computer IP address
    vii. How to ping devices to ensure good communication
    viii. How to access robot web page
    ix. Use robot web page to access vision setup screen
b. Perform Error Recovery

i. How to check for impediments to servo power-up
ii. How to remove impediments to servo power-up

c. Tool Frames
   i. Tool frame overview
   ii. Tool frames for vision
   iii. Tool frame for robot applicator
   iv. User frames necessary for use with vision system
   v. Use a Tool frame
   vi. Offset user frame
   vii. Teaching the calibration grid frame
      1. Using the four-point method
      2. Using the five-point method

d. Setup an Inspection process
   i. Single-view inspection process
   ii. 2-D multi-view vision process
   iii. 3-D inspection process
   iv. Setup the camera
      1. Lens
      2. Camera Cable
      3. Multiplexor
      4. Communication cable
      5. Calibration grid
      6. Laser vision sensor
      7. 3D Multiplexer

e. Train the vision system to recognize the part
f. Program the robot for vision interface and part handling
g. Camera properties
   i. Focal Length
   ii. CCD (Charge-coupled device) width
   iii. Standoff
   iv. Field of view

h. Setup 2D or 3DL Single View process
   i. Calibration screens for 2D vision
   ii. Calibration procedure for 2D vision
   iii. Height variations
   iv. Perspective calibration
   v. Orthogonal calibration
   vi. Process screens for 2D vision
   vii. Single view process setup procedure for 2D
   viii. Program the robot to respond to vision results

Resources

Andrew Kelleher, Adam Kelleher. *Applied Machine Learning for Data Scientists and Software Engineers: Framing--The First Steps Toward Successful Execution*. 1st. 2018.

Batchelor, Bruce G. *Machine Vision Handbook*. Volume 1. 2012.

E. R. Davies. *Computer Vision*. 5th. Academic Press, 2017.

Manuela Chessa, Fabio Solari and Silvio P. Sabatini. *Human-Centric Machine Vision*. 1st. Intech, 2022.

Peter Corke. *Robotics, Vision and Control*. 2nd. Springer, 2020.

Song Zhang. *Handbook of 3D Machine Vision: Optical Metrology and Imaging*. 1st. CRC Press, 2021.

Resources Other

a. Andrew Kelleher, Adam Kelleher. *Applied Machine Learning for Data Scientists and Software Engineers: Framing--The First Steps Toward Successful Execution.* 1st Ed., Addison-Wesley Professional, 2018.
b. Batchelor, Bruce G.. *Machine Vision Handbook.* Volume 1, Springer, 2012.
c. E. R. Davies. *Computer Vision.* 5th Ed., Academic Press, 2017.
d. Manuela Chessa, Fabio Solari and Silvio P. Sabatini. *Human-Centric Machine Vision.* 1st Ed., Intech, 2012.
e. Peter Corke. *Robotics, Vision and Control.* 2nd. Ed., Springer, 2017.
f. Song Zhang. *Handbook of 3D Machine Vision: Optical Metrology and Imaging.* 1st Ed., CRC Press, 2017.

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