PRIMARY DEVELOPERS:
Glenn Wisniewski – Corporate Trainer, Henry Ford College
Wes Bye – Mechatronics SME, Pontiac Coil

Mechapracticum Outline

Robotics

Topic: Robotics

Note: depending on equipment availability, the applications may vary by school.

Estimated completion time: 16 Hours

Purpose:

The purpose of this Mechapracticum is for the participant to demonstrate their ability to set-up and use the components of a robotic system as prescribed in this document.

Instructional Outcomes: Currently identified by application

Instructions to Students

Alarm Screen

Student will navigate to the active alarm screen when a fault is present. Then, use the onscreen diagnostics to access the information pertaining to the fault. The student will list the probable causes and remedies.

Student will access the alarm history screen to check for related faults.

Axis Limit

Student will modify the axis limits, and then test by jogging and viewing the current position screen. Requires a Cold Start of the robot.

Edit

Students will be given a program on the Teach Pendant to edit.

- Insert and record a new Position.
- Add an IF statement based on a Digital Input to a Label.
- Add the Label.
- Modify the continuous value on two motion statements.
- Change a Joint motion to a Linear motion and change the motion speed value.
- Add a Digital Output to be On.
- Add a wait time statement.
- Add a Digital Output to be Off.

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Tool Frame

Student will set the Tool Frame (TCP) using the six-point method and make active. Student will verify TCP by jogging around the reference in robot World mode.

The Tool Frame setup will be used in the application program.

Macros

Student will create the Macro programs to actuate and unactuated the end effector and assign to the TOOL1 and TOOL2 keys on the Teach Pendant.

The Macro setup will be used in the application program teaching and as a Macro command for the gripper.

Input/Output Monitor and Control

Student will access the Digital and Robot Input and Output screens.

- Monitor Digital Input/Output Status.
- Monitor Robot Input/Output Status.
- Simulate and/or Control Digital Input/Output Status.
- Simulate and/or Control Robot Input/Output Status.

The Input/Output Monitor and Control will be demonstrated in the debug of the application program.

Load and Save Programs

Student will load and copy the below application programs to external storage device.

Application Program

Note, this application will vary with the available equipment at each school.

Students will create a program emulating the loading of two machines from a common feed conveyor. This is to be achieved by moving an object from a common pick-up location, representing the In-Feed Conveyor, and then dropping-off at two different locations representing Machine 1 and Machine 2.

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Note this needs to be modified… we don't have a conveyor system that would support this.

- The program must use the appropriate motions, Joint and Linear; and terminations, Fine and
- Continuous, to minimize cycle time.
- Program must use initializations for program start or restart.
- The cycle start of the program, will have the robot will move from a "Home" position register to a
- "Stage" position.
- Parts are to be continuously feed down the conveyor. The robot will check for a "Part in Position" input.
    - A part present signal will cause the loading of the part.
    - A no part present signal, after a specified time, will cause the following in a sub-program to be executed.
    - The robot to move to a "Maintenance" position.
    - Turn On a "Maintenance No Part" output.
    - After a Digital Input "Reset" the program turns Off the maintenance output and the robot returns to the "Stage" location to check for "Part in Position" signal.
- At the "Part in Position" signal, a sub-program is called and the robot will move to pick-up the part from the infeed conveyor.
    - The program will open the gripper and confirm the opened gripper prior to moving to the part.
    - A gripper open signal failure, after a specified time, will cause the following in a sub-program to be executed.
- Turn On a "Maintenance Gripper" output.
    - After a Digital Input "Reset" the program turns Off the maintenance output and the robot returns to the "Stage" location to check for "Part in Position" signal.
    - A confirmed gripper opened will have the robot to pick-up the part from the infeed conveyor with appropriate motions and terminations and close the gripper and confirm the closure.
    - A confirmed closed gripper will then have the robot retract and return to the "Stage" location with appropriate motions and terminations.
    - A gripper closed signal failure, after a specified time, will cause the following in a sub-program to be executed.

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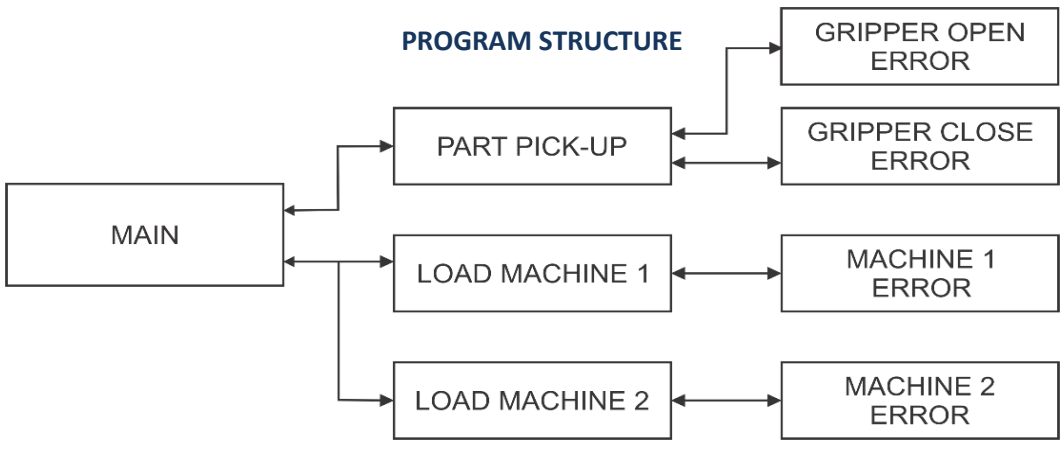
Robotics

- Turn On a "Maintenance Gripper Close Fail" output.
  - Abort the program.
- The program will monitor "Load Request Machine 1" and "Load Request Machine 2" Digital Inputs. To prevent machine 1 from always be serviced, the program must log if Machine 1 has been serviced prior if both Machine 1 and Machine 2 are requesting a part. If Machine 1 has been last serviced, the "Load request Machine 2" is to be recognized.
- A valid Request Load will then call the sub-programs for Load Machine 1 or Load Machine 2.
- The program will move to the specified drop-off (load) location with appropriate motions and terminations.
  - The robot will release the part and confirm the gripper has opened.
- A confirmed opened gripper will then have the robot retract and return to the "Stage" location with appropriate motions and terminations.
- A gripper open signal failure, after a specified time, will cause the following in a sub-program to be executed.
- Turn On either "Maintenance Gripper Machine 1" or "Maintenance Gripper Machine 2" output.
  - Abort the program.



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Safety:

The student will demonstrate safe work practices, safety attitude, and electrical safety practices

Instructions to Evaluator: To be defined

Tools and Equipment: To be defined

Rubrics:

Presentation Key Indicators

***Key indicators** are generalized topics within the scope of the Mechapracticum to use as a guide for the evaluation of the student's presentation to demonstrate knowledge relevant to the subject.*

- Use of Alarm History for tracking problems not related to Active Alarms.
- On screen error code descriptions.
- Axis Limit procedures.
  - Upper and Lower Limits.
  - Cold Start to initialize change.
  - Alarm Code
- Definition of Tool Center Point.
  - Tool Frame setup procedure.
  - Influence on motion path.
- Macro definition.
  - Configuration requirements.
  - Setup of macro name to program to teach pendant key assignment.
  - Use in application program for teaching and execution.
- Input/Output Monitoring and Control.
  - Program development.
  - Debug of application program.
- Load and Copy.
  - Application program.
  - Relevant system file.

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Mechapracticum Outline

Robotics

- Application Program.
  - Outline of Application.
  - Task to be accomplished.
  - Motion paths
  - Logic flow in relationship to error handling.
- Initialization values.
  - Numeric variables.
  - Output states.
- Appropriate use of Joint or Linear motion path in relationship to the application's current task.
- Appropriate use of terminations for cycle time or path accuracy.
- Signals and use in the application.
  - Digital Input Signal, specific time for error handling.
  - Gripper commands, Macros.
  - Time specific gripper signals for error handling.
- Techniques used for recording point locations.
  - Jog modes
  - Sequence of motion teaching.
- Techniques used for debugging application.
  - Single step execution.
  - Continuous execution.
  - Input simulation and control for error handling.

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