**Outline for ME192 Term Project (Lab 5)**

**10-3-14**

**Objective**: Integrate a vision guided robot system into a line operation in a real life application.

**Duration**: Target - Five weeks

**Exercise**: Pick up objects from moving conveyor and place them into tray compartments.

**System Components**:

***Robot***

A SCARA or six axis equipped with single or dual end effectors:

Gripper fingers for tall objects and a vacuum retriever for flat objects.

 Optional – Add a force or proximity sensor to the gripper

***Conveyor***

A reversible, variable speed belt, preferably with encoder output.

Sensors – A through beam as a trigger (min. one set. two sets without encoder)

 ***Vision***

 A single B&W (CCTV or 1K hi-res) camera, mounted above the conveyor.

 Be able to discern the type, vertical location, and orientation of a moving object..

 Use geometric pattern testing and/or learned pattern recognition

***Control***

 Conveyor tracking on the robot controller if conveyor encoder is available, or

 A mini PLC with a pulse counter port, or

 A programmable micro processer, or

 A reprogrammable GAL chip with a timer/counter circuit.

 Plus – a relay board and a signal filtering/conditioning circuit.

  ***Work piece***

 One round and one square, both tall, released on conveyor when robot is ready.

 A shorter set with a round marker on top, if vacuum gripper is installed.

  ***Computations***

Robot-Camera-Conveyor-Object location transformations.

 Linear to angular velocity setting and acceleration control.

 Path generation.

***Programming***

Manipulator motion – Approach, land on object and retrieve it while moving.

 Vision – Identify the object, determine its vertical location and orientation.

Control logic – Synchronize the robot movement and camera image processing

 with the object position on the conveyor.

 ***Operation***

 Manually release objects one at a time on the conveyor as the robot returns to a

 ready position. Use a one button ON-OFF switch for fast E-stop and recovery

 during debugging stage.