Senior Design Project Description

Company Name	Schaeffler Group USA	Date Submitted	5/14/2018
Project Title	Vision Inspection System (SG_VISION)	Planned Starting Semester	Fall 2018

Personnel

Typical teams will have 4-6 students, with engineering disciplines assigned based on the anticipated Scope of the Project. 250 hours are expected per person. Complete the following table if this information is known, otherwise the Senior Design Committee will develop based on the project scope:

Discipline	Number	Discipline	Number
Mechanical	3	Electrical	1
Computer	2	Systems	0
Other ( )			

Company and Project Overview:

Schaeffler Group is a multinational corporation that supplies engineered components to the automotive and industrial sectors. Some notable customer of the Schaeffler Group are Ford, General Motors, Fiat Chrysler Automobiles, John Deere, and Harley Davidson. Components supplied by Schaeffler Group range from a simple ball bearings to Multiair, a hydraulically-actuated variable valve timing which is supplied to Fiat FIRE engines and the Chrysler Tigershark engines.

The students will support a project from the Prototype Dept. The Prototype Department manufactures all order for the INA and FAG brands for the North America region. The Prototype Department is a state of the art facility with capabilities to form, mill, and grind wire EDM, and inspect complex parts. The team consists of ~ 45 highly skilled individuals that plan, design, manufacture, inspect, and deliver quality parts to automotive and industrial customers.

Project Requirements:

Students will develop a visual inspection system to help the Prototype Department catch defective parts / assemblies. A more detailed requirement section will be created at a future date that supplies the part sizes, space restrictions, smallest detectible defect, and various other details.

The students will employ some of the leading edge computer vision programs and methods to catch defective / bad quality parts. This may include topics like image processing, object recognition, text recognition, feature recognition, and shape recognition. The students will be responsible for

the whole system starting from sensor selection, creating or selecting a processing engine, and communicating the results. This will require students to select a camera, correct lighting, staging, processing, automating, integrating, creating a user friendly GUI, reporting, and calibrating. The students will also get the chance to explore artificial intelligence topics like machine learning, deep computer vision topics and pattern recognition using artificial neural networks.

The project will be broken down in 3 tiers. The priority will decrease with tiers, with tier one being the most important.

Tier 1:

The machine must look for missing rollers within an assembly.

Missing Roller Check

1. Thrust bearings (AX)
2. Needle roller bearings (KZK)
3. Drawn cup needle roller bearings (HK)
4. NORO assembly for finger follower

Tier 2:

The machine must look for surface defect on a raceway of inner and outer washer

Surface Defect Check

1. Inner washer of Thrust Bearing (AX)
2. Outer washer of Thrust Bearing (AX)

Tier 3:

The machine must perform geometry / feature check on different components & assemblies

Feature check

1. Stakes, anti-reversal and grip tabs check – count option (AX washers)
2. Rotors, Stators, Sprockets – feature check (Machined components)
3. Etc. (add items later)

The machine must do the following:

1. Must be mobile
2. Must use only AC power
3. Must have a foot print of?? x?? ft
4. Must be self-contained – PC, Camera, Mechanical Sys, Bins, Signals, Lights, Display, Etc.
5. Must not require coding / programing
6. Must store programs / setup under part # and print version
7. Must check wide range of part diameter and heights

8. Must move / slide bad and good parts into different bins
9. Must keep a count of good vs. bad parts
10. Must alert user when bad part is found (visual or sound)
11. Must alert user what the issue is
12. Must be easy to use and setup
13. Must use readily available components, software
14. Must be designed and build using engineering standard methods
15. Must be supplied with wire diagrams, mechanical drawings or models

Machine should do the following:

16. Have an auto adjust / focus feature
17. Allow for larger part portfolio for future growth
18. CAD or DXF file compare
19. Object overlay
20. Visual measurements of features (diameters, distances, etc.)

Expected Deliverables/Results:

The students are expected to deliver at a minimum a standalone machine that completes all tasks for Tier 1 and meets the requirements stated above. Along with the machine, the students must provide technical drawings, BOMs, instructions, and information.

Disposition of Deliverables at the End of the Project:

All hardware can be delivered to the Tech Center Dock at the following address after the project ends.

Automotive Tech Center
Attn: Parth Parmar
308 Springhill Farm Road

Fort Mill, SC 29715

List here any specific skills, requirements, knowledge needed or suggested (If none please state none):

- Computer Programing (Python, Matlab, Java, C, C++, etc.)
- Computer Vision Knowledge (Image Processing, Object Recognition, Text Recognition, etc.)
- Automation Experience (Sensor, Arduino, Electric Wiring, Pneumatics, Electric Actuation, etc.)