Group 22 – Automated High Volume Bearing Bore Gage

Needs Assessment

Deliverable 1

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Problem Statement

The objective of this project is to improve the out-of-date bearing bore gage system used by Koyo Bearings. This improvement must advance the user interface while maintaining the quality of the measuring device and the sampling rate. The improvement should also allow for the communication of each gage to a central terminal. This will allow for multiple systems to be monitored from a single device.

Background

The sponsor, Koyo Bearing, has been implementing a bearing bore gage system for over 30 years. Currently, the system can be accessed only at the terminal on each individual device. A full system update from the company who created the device would cost $40,000 per unit. In order to reduce cost, they have requested a design by the students at FAMU-FSU College of Engineering.

The system consists of a tube television, keypad, pneumatic pressure system, and a testing platform. The system uses the pneumatic gage to determine the bore of a bearing and either accepts or rejects the part based on tolerances. The devices are stationed at the end of milling machines which feed bearings into it. When three bearings have failed in a row, the device alerts the operator in order to cease production of inaccurate parts. The bearing gage system is implemented in a facility that produces 400,000 bearings each week.

Objective

The main goal for this protect is to retrofit the bearing gauge testing console with a new computer, operating system, and display. In addition, the machine should later be able to connect to the network at the Koyo plant. Projected date of completion is May 2014.

- **The plan for the Fall Semester:**

1. Research the inner workings of the machine and components.
2. Research for a heavy duty industrial rated computer and display.
3. Make bill of material for all the parts needed to complete this task.
4. Submit our design to Koyo Bearings.
5. Quote and order all parts needed for the design.

Methodology

The designing of this retrofit will be broken down into multiple phase. The first phase will be to study the behavior/controls of the air transducers. Then there will be a group decision, consisting of the team members and project advisors, to see if there is any need to replace the transducers with a different style of pneumatic transducer. Phase two will be to research the new heavy duty industrial rated computer and display. Phase

three will be to design a complete working system, then submit the design to Koyo Bearing. Phase four will be to make a bill of material and then order the parts needed. Phase five will be to make scope of work for the spring semester.

Expected Results

After a conversation with Mr. Potts, we have learned that the machine used for measuring bearing tolerances at Koyo bearings measures them with 100% accuracy. This guarantee is very important to the relationship between Koyo and their customers. As with last year, Mr. Potts stressed that any modifications and improvements to the bearing bore gauge must not hinder the accuracy of the device. We will need to update the display of the gauge with a PLC device as suggested by last year's team that is able to show all of the parameters that is currently displayed on the old machine. The current Koyo bore gauge is outputting an unconditioned signal from the LVDT (linear variable differential transducer). Koyo would like us to find out how this signal can be modified so that it gives us a useful signal that can be read. This new signal would be routed to the PLC device, and with the aid of simple software like Matlab or LabVIEW, to output specifically the information that Koyo needs from the gauge. The measurement software Koyo is currently using is sufficient, but it does way more than Koyo requires of it, and our modifications would provide a cheaper and more specialized alternative. Another request of Mr. Potts was that we develop a network that would allow all similar bearing bore gauges at Koyo to communicate to each other. Making it so multiple machines could be controlled and monitored from one device. This was not a design requirement, and the group feels that the scope of that undertaking could be too large for what we can accomplish in one year, but that we could get this project to a point where a team coming in next year could take on that problem.

Constraints

There are many constraints that must be taken into account starting this project. Money will be a large constraint. It will determine what technology we can actually use in the redesign of this bore gauge. We have not received an official budget from Koyo bearings at this time, but we have scheduled a trip out to Koyo bearings headquarters where we expect to receive a budget. Another constraint to this project is time. We will have until the end of this semester to explore all design options and decide on a final working prototype. Our goal is to order all parts needed for the physical prototype by December to ensure that when we come back for the spring semester we have everything we need to begin on our prototype. This will give us ample time to troubleshoot and make any modifications to the design that are needed in order to deliver a finished product.

Design Requirements

Hardware

1. Pneumatic gauges
    a. Current gauges are operational for current setup, but unsure how to read electrical output
    b. Reusing current gauges is desired but new gauges might be necessary
2. Central processing Unit
    a. UNO-2059GL-3S50
3. Touch screen
    a. Advantech FPM-5191G-XOAE 19”
4. PLC
    a. Maintaining current PLC is desired

Software

1. LabVIEW
    a. This software was recommended by last year’s senior design team and is capable of performing the required work. It has diverse programmable inputs such as block diagram logic or C++ style coding for both the skilled and unskilled programmer.