

assignment 1 5007

by Sean Jones

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Assignment 1

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HNC electrical and electronic
engineering

Individual project

PSDE

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1. Project proposal

The problem

A customer has a problem to check that a part has been correctly assembled on a production line and seeks to modify their production to accommodate a parts checking system.

The part is an aluminium yoke with two O-rings which get placed on the part on the production line by an operator. A means of testing the correct seating of the O-ring will need to be developed

This will be an R&D prototype setup to prove the feasibility for a full automated system

This checking is to prevent bad parts going to the customer

This will be done using the resources at EBS automation.

The solution

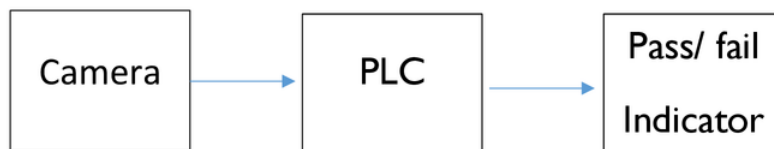
An investigation will be carried out to implement a method of testing the O-ring installation on the aluminium yoke.

Some of the alternatives that will be investigated sensors that can be used or possible camera development to test it graphically

The project will be developed during the work hours within a scheduled timing plan.

The project management will be achieved by creating a Gant chart which will indicate all processes of the project against a time line. This is to ensure targets are met and also indicate where problems and waiting time have occurred.

Two other methods of implementing this project will be investigated and one will be tested for suitability.



Project must be completed by the 25th of April 2018

The budget is £2000

2. Background Research

The project is to find out whether a fully automated machine can be made to test a part. Due to the sensitive nature with visual sensing on a part a fully automated machine can't be built straight away as it would not be guaranteed and could lose the company a lot of money. For this project to be a success then the machine will need to consistently determine if parts are passed or failed. The slightly automated parts of the machine are only there to speed up the testing procedure of this machine.

The company has the capability of producing this machine and everything will be done in house. The part is from an external company so they have sent over information of the yoke as below in Figure 1 the use of the yoke and Figure 2 drawing of the yoke.

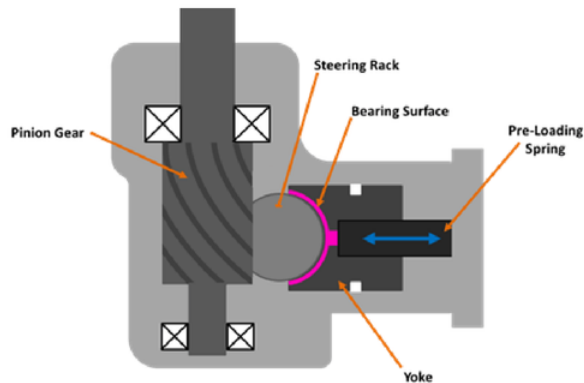


Figure 1 the use of the yoke

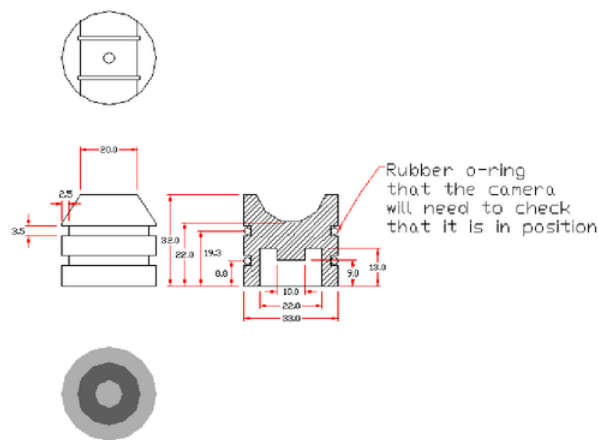


Figure 2 drawing of the yoke

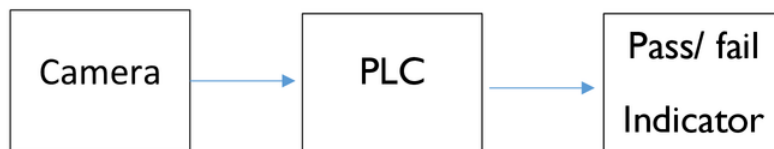
These drawings will help give a better understanding of the part. The drawing with the dimensions of the part was used to create the mechanical drawings of the machine.

A camera will need to be used to reliably sense for the O-rings. The only part of the project that has multiple options is the control of the system. These options are to use a PLC to control the system, a pic or relays and arranged hard wiring.

Using a PLC

A PLC is a very high cost approach to the project. According to (parmley-graham, 2017) the cheapest 1200 series PLC is £171.00. Additional to this high cost there is a lot of time related to the PLC route of this project. Training would be required to program the PLC and additional time scaling would be required for this training and for writing the PLC program.

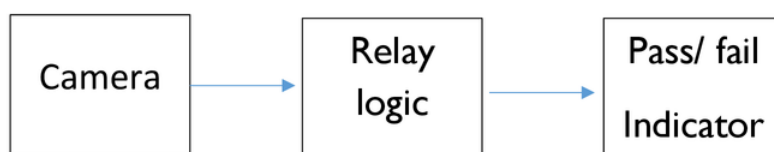
The advantage over using the PLC would be the range of functions that are available. For example sequencing can be made very easy in comparison to relays as it can all be done in the logic. The time to design the electrical circuit would be reduced as there isn't any tricky relay logic which needs to be included. The greatest advantage of the PLC is future expandability which relays can't offer. (metroid, 2018) States "A small PLC can be roughly the size of a house brick. On the other hand, a row of 10-20 relays can be twice the length, and require twice the amount of wiring (i.e. larger cable ducts)."



Relays

Relays are a very cheap and simple way of performing some sort of sequence. This method is only viable with small sequences as too complicated of a sequence will need too many relays and make it cost more than a PLC. (metroid, 2018) States "For small and simple control systems, relay logic can be ideal – it's low cost and easy to service."

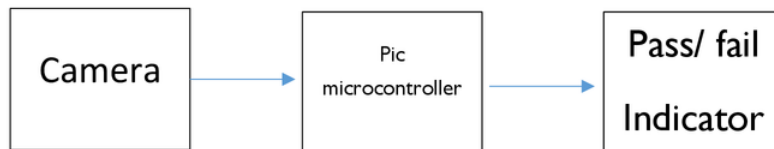
The great disadvantage of the relays are that at the very start of the project it's got to be certain that all the desired tasks that are to be performed can be done with only relays. If it is found out later that there's something that can't be done with relays then it can be very costly as a PLC may need to be bought as well and could put the project over budget.



Pic microcontroller

A PIC is a very small device which can perform a lot of functions. This device is also very cheap and would make the project well under budget. The Pic can also perform many functions that relays can't.

A lot of research would be required to use the PIC as EBS doesn't do anything with electronic circuits. This would create a large setback in the project which would jeopardise the plan.



3. Specification

For the system to pass final testing it must meet all the following information.

Mechanical features

- Be no greater than 500mm³ excluding the electrical enclosure
- Have guarding in high risk areas.
- Parts must not be dented or scratched throughout the process.

Electrical features

- A IFM o2d222 camera must be used to sense an O-ring.
- All 24vdc cables must be of thickness of 0.75mm².
- The circuit must be easy to modify as this is a development project.

Additional information

- The machine will have a start button which will be green. The purpose of this button is to start the sequence.
- There will be a reset switch which will reset the machine if there is a failed part.
- The machine will have a red light to say when a part has failed this light will remain on until a reset switch is turned.
- Have a chute so parts can be back filled
- The machine must be semi-automated and have the operator must only have to inset parts into the chute, collect them from the passed area and remove them from the test area when failed.
- The machine must move the part from the test area into the pass area when passed.
- The cycle time must be at least 1 part every 10 seconds.
- Failed parts must be removed manually.
- A part will be deemed as a pass if both O-rings are in place.
- A part will be deemed a fail if either or neither of the O-ring are not in place.

The budget of £2000 should be strictly followed and if the budget looks as if it is going to get overshoot then a meeting with the supervisor must take place to take action to either increase the budget or find a solution around the problem. The budget is only for the bought out parts of the machine. Software, training or hourly production rate is not included in this budget.

4. Testing Plan

The system will have a critically test to ensure the system meets the specification.

The system will be broken down into work areas where individual components can be bench tested before implementation.

Tests will be carried out at work site to satisfy that the original specification is met.

Any alterations will be discussed by management and engineers where compromises may be necessary.

A table of results will be produced which will show how the end product performs against the specifications.

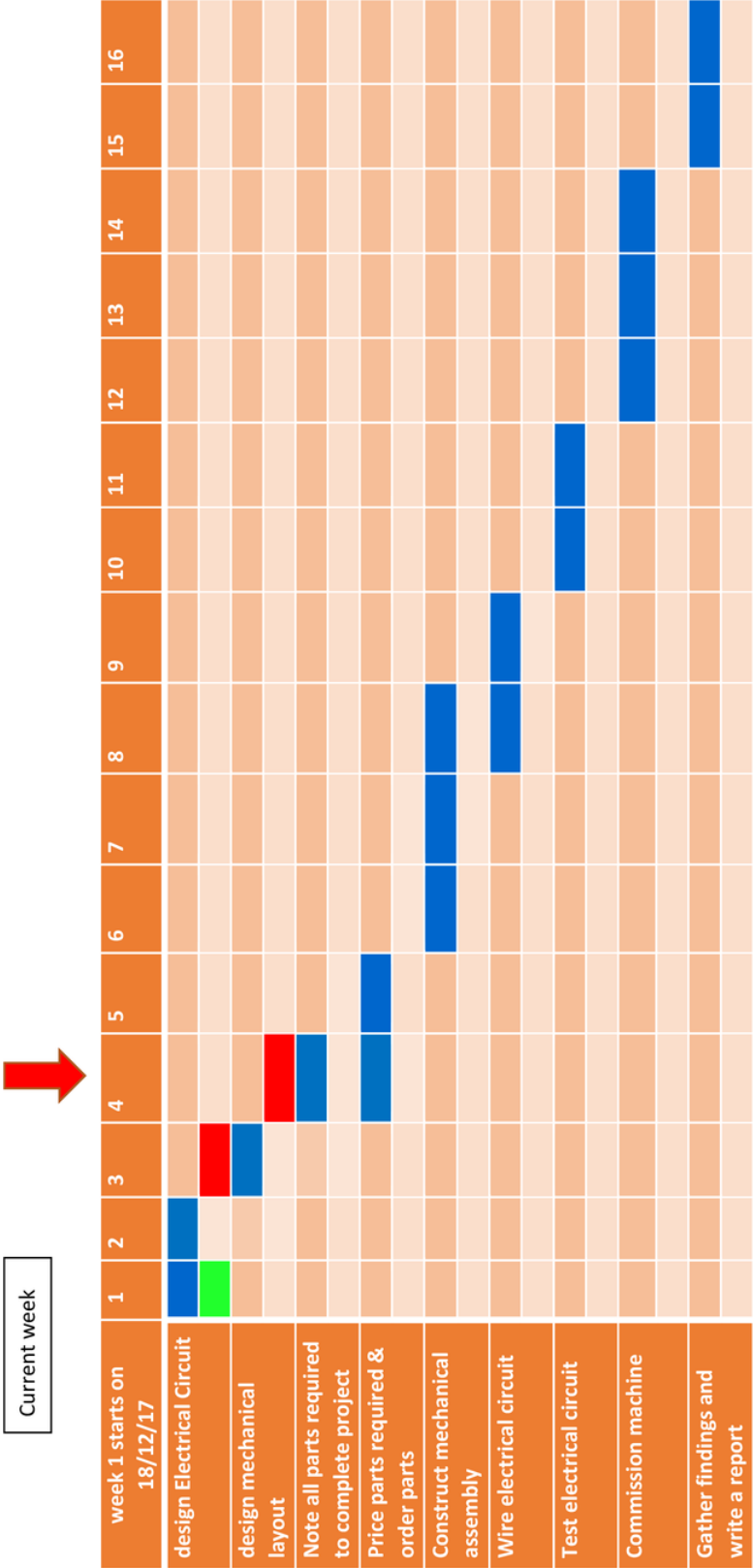
The machine must be proven to repeatable so it must continuously run to make sure the machine is consistent.

5. Project Plan

The project will last over 16 weeks starting from the 18th of December 2017. To keep track of the project and to ensure it doesn't run on for too long there will be a gant chart used to monitor the progress. A gant chart is the best way to represent this as it shows a graphical representation of the milestones being met. If a milestone is not met then it will be marked on the gant chart to show this. Greater work input will have to be put in if a milestone is not met to ensure that the project doesn't fall behind schedule.

The 4th week is the current week of the plan. The project is currently 1 week behind schedule. This was due to the oversight that a week will be lost for the Christmas holiday which put the project behind schedule. Assist may be needed on the mechanical assembly to get it done quicker to get the project back on track and prevent the project being late

GANTT CHART SHOWING THE PLAN OF THE PROJECT



6. Design requirements

It was chosen to go with the relays to control the system as it would easily be designed and wired also it was chosen due to plenty of previous experience with relays so design time and commissioning time would be reduced. The cost of the relays will help the project be within budget easily. About 4 relays will be needed to perform all the functions required.

The image below Figure 3 shows what the rough layout of the system may look like. This shows the potential layout of the camera, chute and passed part actuator. The camera has the same position in relation to the part that was tested previously. This is to prevent any unwanted delays in the project where the camera may not work as it did when being tested.

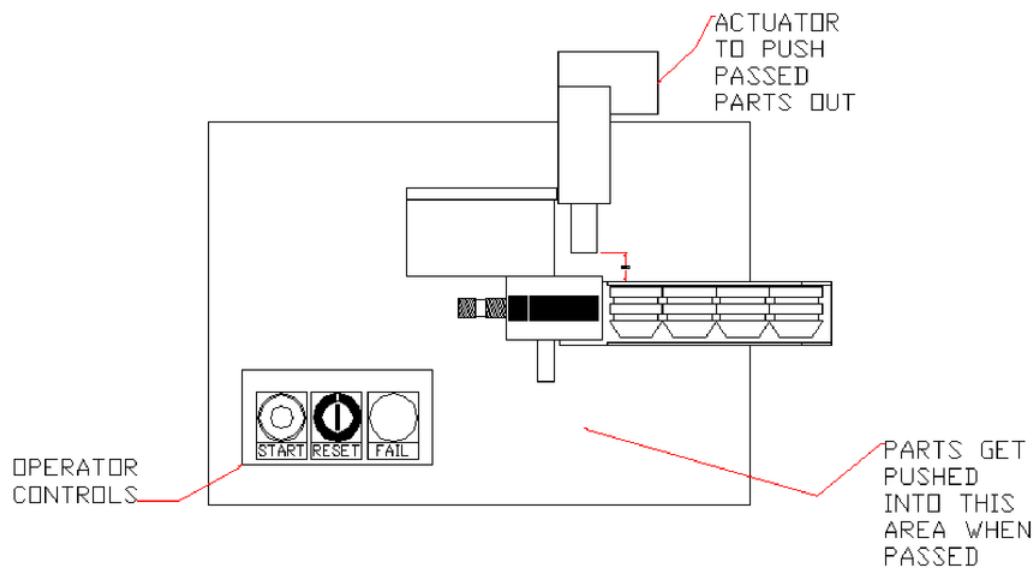


Figure 3 machine layout

The buttons are kept away from the main part of the system so an operator won't have their fingers near the moving parts of the machine when the machine starts. It's also placed over to the left so the operator can press start easily with the opposite hand that filled the chute up.

There is a part present sensor at the bottom of the chute that will sense a part to trigger the camera. This sensor would have to be set up so that it can't see the arm of the actuator when it pushes a passed part out.

The electrical diagram was drawn up. This is issue 1 for the electrical drawings as later modifications may be needed when the system is being commissioned. This is normal where overseen problems may affect the electrical circuit design.

All the relays and control of the circuit will be 24vdc. This will insure the machine is very safe as no dangerous voltages are present. The main advantage of the 24vdc is that sensors and relays are cheaper and the price of a dc power supply would be cheaper than paying extra for the components.

The electrical actuator works off to wires where the polarity of the current placed on the device will determine which direction of which the actuator will move in. this can be done easily in an electrical circuit with 1 2-pole relay, as shown in Figure 4.

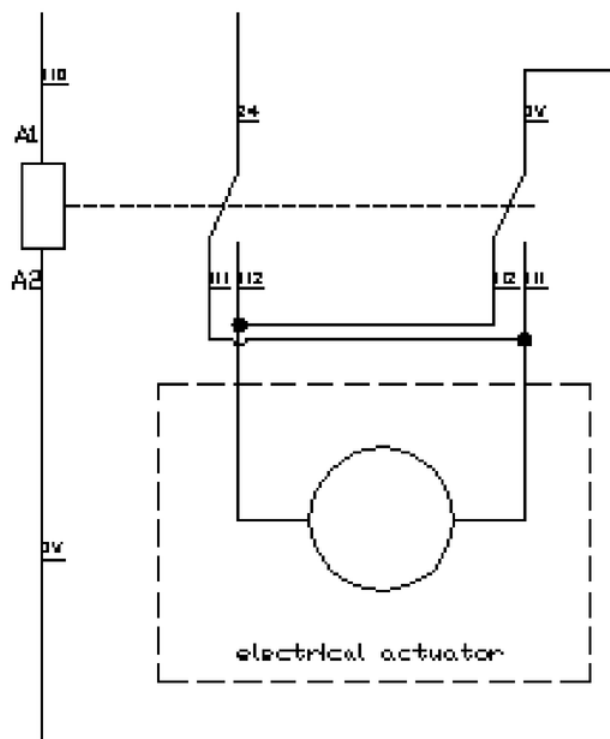


Figure 4 actuator wiring

7. Discussion and Conclusions

The main differences in solutions throughout this report discuss the different types of control over the system. The two greatest parts that affect the type of control of the system is money and expandability. This project is on a tight budget that is largely taken up by the camera which leaves very little room for the PLC. A PIC would be the next best thing but due to the camera needing a lot of time spent on it to programme it and to commission it. There isn't a lot of time for error in aspect of trying a new type control system. If the timescale was greater, using a PIC as the controller would have been really effective in the cost side of things and a very strong sequence.

Due to the time scale and cost the relays were the most suitable for the project. As long as there aren't any unforeseen problems that occur during the wiring process or the commissioning of the system that will delay this system then this should be really effective for this type of project.

Both electrical and mechanical design of the project has been completed.

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GRADEMARK REPORT

FINAL GRADE

GENERAL COMMENTS

Instructor

45/100

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GRADING FORM: CSG-RUBIC

SEAN JONES

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RESEARCH-INFORMED LITERATURE



Limited research. More needed. - 3/15 Refs are good, but not all are used in text. - 4/10

7/25

KNOWLEDGE AND UNDERSTANDING



Reasonable proposal. Use of images would have helped here. - 6/10 Spec is reasonable. - 3/5 Design requirements needs more work.- 4/10

13/25

ANALYSIS



Need to use table method for testing. More effort on this section needed. - 4/10 Conclusion is poor. - 4/10

8/20

PRACTICAL APPLICATION AND DEP.



A good start. Plan looks good - 3.5/5 Quality of work is reasonable - 2.5/5

6/10

SKILLS FOR PROFESSIONAL PRAC.



needs more effort - 5/10 Presentation 6/10

11/20