

Jonathan Pulman

by Jonathan Pulman

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*The contents list can be
subdivided to give more
details*

Introduction and background research for project.

Avoid first person terms

To begin, the company I am employed by is Gestamp. The Llanelli plant is where I am based and has been around years, previous known by many different names. The company work on creating and designing car parts for various different companies. These companies range from our highest supplier being jaguar Land Rover, to our other companies being Vauxhall, Renault, Aston Martin, Nissan and Honda. Through the plant we have different areas in which the parts are created, there is the press shop, assembly area and the new area hot stamp which has also started a new job of cold stamping. The cell which my project has gone on is the D2W0 cell. The project will be explained below and the reason behind it will show why the need for this improvement was needed.

This project was designed and created to assist operators in the work environment on a particular cell which was having problems with the amount of parts that are being and have been scrapped. These parts are costing the company money to make and costing more to scrap. Along with the scrapping of parts the issue of sending uncompleted parts or damaged goods out to the customer is again causing problems for the company. The cell that's been having the most issues is the D2W0 cell, which was mentioned above. This cell is most likely scrapping hundreds of thousands of parts a year, but along with that there are parts being sent out without parts attached to them. This makes up another list of figures in which are sent back for rework or scrap as well. After having conversations with the technical support group that are in work, one of them was assigned to have a look at the issue and find a way to amend the problem. Then after this me and Scott started working together on the issue.

As shown in logbooks. There is a small part which is placed on the bottom of the bumpers. This part is a manual task and can easily be forgotten. However, since there have been many issues with this cell and approach to this was needed. The company came up with a solution on how to fix the problem to an extent which would make it easier for the operator to check that the part is fully ready to placed in the completed work. However, for this another 2 solutions were needed. Another solution was discussed but it would take longer, cost around the same and involved too much time on production. Therefore the original idea was stuck with. The idea and solution that we went with was a camera which was integrated into the PLC to allow signals to be sent into the cell safety and to run into the HMI. The operator would then see that there would be an issue with the part or parts and will be aware of it.

A good reference to log books



The problem is defined

The object of this solution is to get the camera to pick up the part on the back end of the bumpers and to give a signal off to say the parts are okay. The camera is to be set up at the end of the conveyor and will be mounted and secured. Due to them needing it in the line, the testing work will have to be done on the bench. The aim of the camera is to pick up the part shown below in the image.



Good supporting image of the problem

Before anything could be planned or bought, research into this task needed to take place. The idea of a camera was already used and seemed to be the most favoured solution, therefore the research was based around what type of smart cameras are out there, what they do, what type of objects can they pick up, range, durability etc. This was all covered before the solution was finalised, this was based around the project proposal. By researching, the correct camera was found and PDF files were also provided with the camera once it was purchased. These files covered installation to how the camera works, how the camera would pick and object up and the many different types of ways you could set the camera up, range and general information about the camera itself.

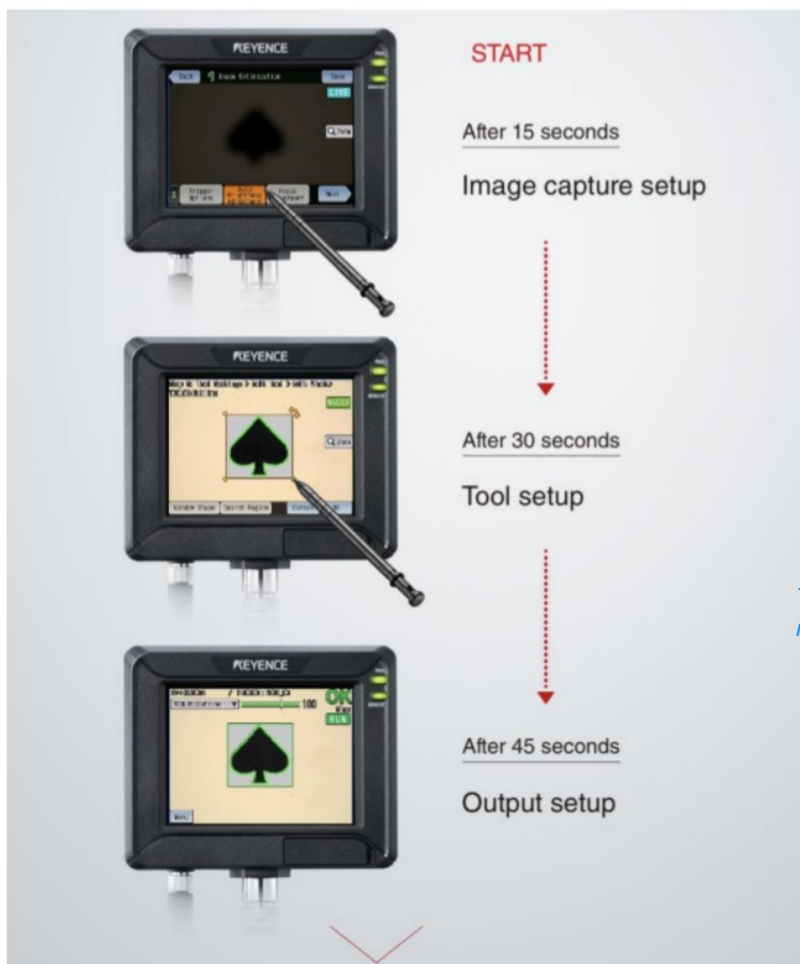
	Engineer's KNOW-HOW MACHINE VISIO...	02/04/2019 06:04	Adobe Acrobat D...	1,295 KB
	Engineer's KNOW-HOW MACHINE VISIO...	02/04/2019 06:05	Adobe Acrobat D...	1,382 KB
	Engineer's KNOW-HOW MACHINE VISIO...	23/10/2018 06:12	Adobe Acrobat D...	989 KB
	IV Series Vision Sensor Catalogue	23/10/2018 06:15	Adobe Acrobat D...	5,394 KB
	KEYENCE - Vison Sensors Applications	08/08/2019 20:04	Adobe Acrobat D...	1,906 KB
	Machine Vision Academy	19/09/2017 14:16	Adobe Acrobat D...	940 KB
	MACHINE VISION Vol.5	25/09/2017 14:19	Adobe Acrobat D...	1,056 KB
	Vision Sensor - AS_86009_TG_600K66_GB_...	16/10/2018 06:00	Adobe Acrobat D...	342 KB
	Vision Sensor Tips - AS_97093_TG_600Q7...	16/10/2018 06:01	Adobe Acrobat D...	1,079 KB
	Vision Sensors - Automotive	18/06/2019 12:26	Adobe Acrobat D...	1,906 KB
	Vison Sensors Applications	16/07/2019 08:52	Adobe Acrobat D...	1,906 KB

There is clearly research carried out, but there are no supporting sources for this.

The image above is showing the various files that was sent with the camera. All these files covers general information, to how to set up the camera itself.

In the project proposal, The cost and various other questions were answered. There was no set budget with the project, by already having the PLC Siemens in place on the line, WHAT TYPE. The cost only really cover the camera needed, cables used and maybe a mounting bracket. The timescale of this project is around 7 months. The starting date was end of October, around 24th October. The project was worked on and completed by January 28th, however, we were given until the 20th April to complete the project and the final report. This needed to have testing involved as well. The progressed has been tracked through these past months via two methods. The first being logbooks on what tasks were undertaken and by testing. While carrying out all this work, the assistance will be provided by Scott, the technical support personnel I am working with.

With the camera being a main solution in which is being heavily researched, here are some images of the files sent over with the camera. The main feature that the first solution has with the camera is the quick and easy set up for the camera itself. This can be seen down below, taken from the PDF files sent over by the company.



With this set up on detecting the part made it very easy to set and once linked with the PLC it would make it easier to pass around the information. The hardest part was fitting it where it would see the part.

For researching more about the camera for the first solution, a few more PDF's were downloaded with more information about how the camera can work and what it is capable of. These images are from the PDF sent over and from the company itself.

Wiring color	Name	Assigning default value	Description
Brown	DC24V	-	+ side of power
Blue	0V	-	- side of power GND of input-output cable
Black	OUT1	Total judge (N.O.)	Output assignable function • Total Status • Tot.StatusNG • RUN • BUSY • Error • Pos. Adj.
White	OUT2	BUSY (N.O.)	
Gray	OUT3	Error (N.O.)	• Judge result of each tool (Tool 1 to Tool 16) • Result of the logical operation of each tool (Logic 1 to Logic 4) • OFF (not used)
Orange	OUT4	OFF	
Pink	IN1	External trigger ↑	Set external trigger. Activation timing (↑) or deactivation timing (↓) can be set.
Yellow	IN2	OFF	
Light Blue	IN3	OFF	Input assignable function • Program bit0 to bit4 • Clear error • External master • OFF (not used)
Purple	IN4	OFF	
Green	IN5	OFF	
Red	IN6	OFF	
Drain	FG	-	Insulated frame
Cable specification		• Brown/Blue/Black/White/Gray/Orange : AWG25 • Pink/Yellow/Light Blue/Purple/Green/Red : AWG28 • With braided shield cable (with drain cable)	

What is the source of this information about the camera

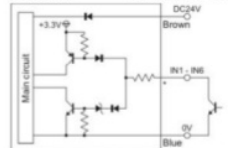
Image showing the wiring for the camera.

Input circuit

■ No-voltage input (When NPN output is selected)

When NPN is selected in I/O format, the circuit becomes no-voltage input circuit. External power supply is not necessary.

- ON voltage : 2 V or lower
- OFF current : 0.1 mA or lower
- ON current : 2 mA (short circuit)

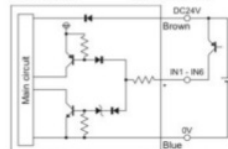


* Pink (IN1: External trigger) / Yellow (IN2) / Light Blue (IN3) / Purple (IN4) / Green (IN5) / Red (IN6)
Use by assigning the optional functions to IN2 to 6

■ Voltage input (When PNP output is selected)

When PNP is selected in I/O format, the circuit becomes voltage input circuit.

- Input maximum rating : 26.4 V
- ON voltage : 15 V or higher
- ON current : 2 mA (for 24V)
- OFF current : 0.2 mA or lower



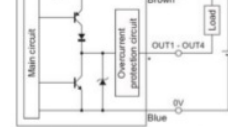
* Pink (IN1: External trigger) / Yellow (IN2) / Light Blue (IN3) / Purple (IN4) / Green (IN5) / Red (IN6)
Use by assigning the optional functions to IN2 to 6

Output circuit

■ When NPN output is selected

When NPN is selected in I/O format, the circuit becomes open collector NPN output circuit.

- Maximum rating : 26.4 V, 50 mA
- Remaining voltage : 1.5 V or lower

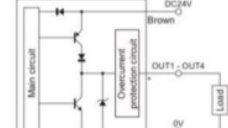


* Black (OUT1) / White (OUT2) / Gray (OUT3) / Orange (OUT4)
Use by assigning the optional functions to OUT1 to OUT4

■ When PNP output is selected

When PNP is selected in I/O format, the circuit becomes open collector PNP output circuit.

- Maximum rating : 26.4 V, 50 mA
- Remaining voltage : 2 V or lower

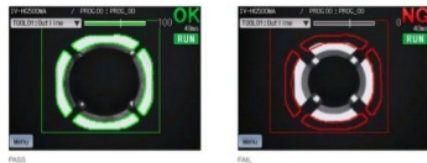


* Black (OUT1) / White (OUT2) / Gray (OUT3) / Orange (OUT4)
Use by assigning the optional functions to OUT1 to OUT4

Image showing the different circuits.

SHAPE DETECTION

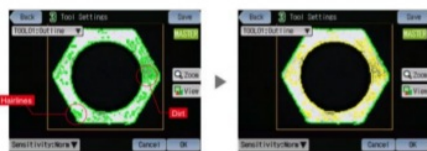
The match percentage of the object is calculated based on the shape of the registered master image. Brightness differences or differences in individual surface conditions, which were previously difficult to handle with normalized correlation methods (pattern matching) can now be identified.



Useful Functions That Provide Even Greater Stability

MASK OUTLINE

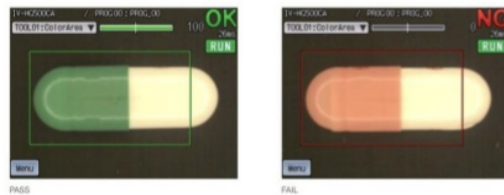
Outlines that are not relevant to the detection can be disabled. This makes it possible to perform stable detection even when hairlines or dirt are present on metal targets.



Everything other than the outline to be detected can be disabled.

AREA

Using the registered master area (number of pixels) as reference, the difference in area from the inspection object is calculated. When using a color model, judgment is made on the basis of the area of the specified color. When using a monochrome model, brightness is judged by the area binarized in black and white.



Useful Functions That Provide Even Greater Stability

POSITION ADJUSTMENT

The position adjustment function calculates the amount of misalignment from the master image in order to correct the position and enable correct judgment. In addition, 360° rotation is supported, which means there is no need to worry about workpiece misalignment. Support for high-speed tracking is also possible.



The images show that the camera is capable of processing images

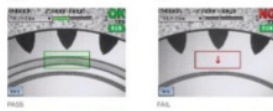
EDGES

This tool detects the boundary between the bright and dark parts in an image. KEYENCE's proprietary edge strength optimization algorithm can be used to stably detect targets that have variations in edge contrast.

EDGE PIXELS



EDGE PRESENCE



WIDTH/HEIGHT



PITCH



DIAMETER



OCR NEW

YO-HO Series

This tool detects whether the text/date on the target being inspected matches the text/date information in the registered master image. The text/date is compared against the large number of internal character fonts that have been preregistered, and targets that match are identified as being text/dates.



Just Outline to Identify Text

There is no need to perform extraction (adjusting the character width and height), register a dictionary, or any other setting configurations required with conventional vision sensors. Just outline the text to identify it. Furthermore, stable reading is possible even if the conditions of the text's shading, thickness, and size change.



Draw the window...

to automatically identify the text.

Supports a Wide Variety of Marking Devices

Inkjet printer



Standard ink



White ink



In addition, various text formats such as those of thermal printers, dot printers, and dot characters are supported.

The four images above just show some basic information about how the camera itself works and what the camera is able to capture.

The
images
show the
camera
can
capture
small

Solution 1

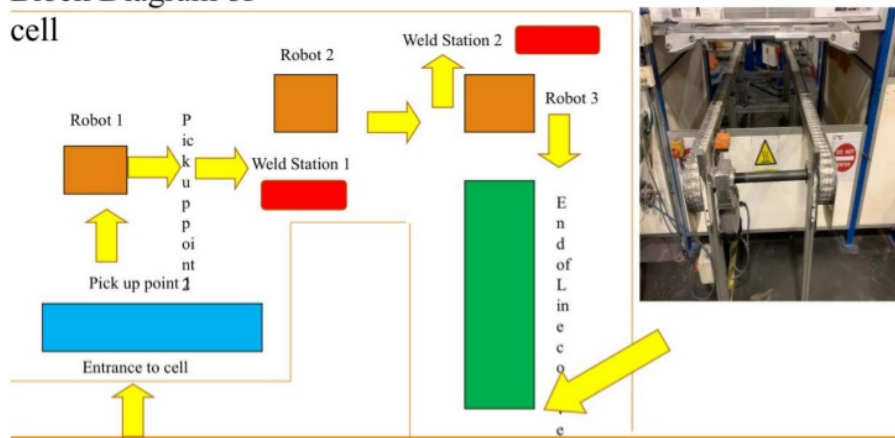
The first solution and the solution, as mentioned before was the smart camera. This smart camera would be placed on the end of the line conveyor and would detect if the missing part was attached. The issue with the placement was the cell. Due to robotic movements taking place inside the cell and weld points inside the cell, it proved difficult at first on where the camera would be mounted. The issue with the camera being placed at the end of line conveyor is the fact that the part has already been through the sequence without this part. But at least there would be less wastage if it were missing.



Good argument and image of this possible solution. No reference sources included.

Along with this a block diagram cell was made to help show the process since going into the cell is a problem when it's running.

Block Diagram of cell



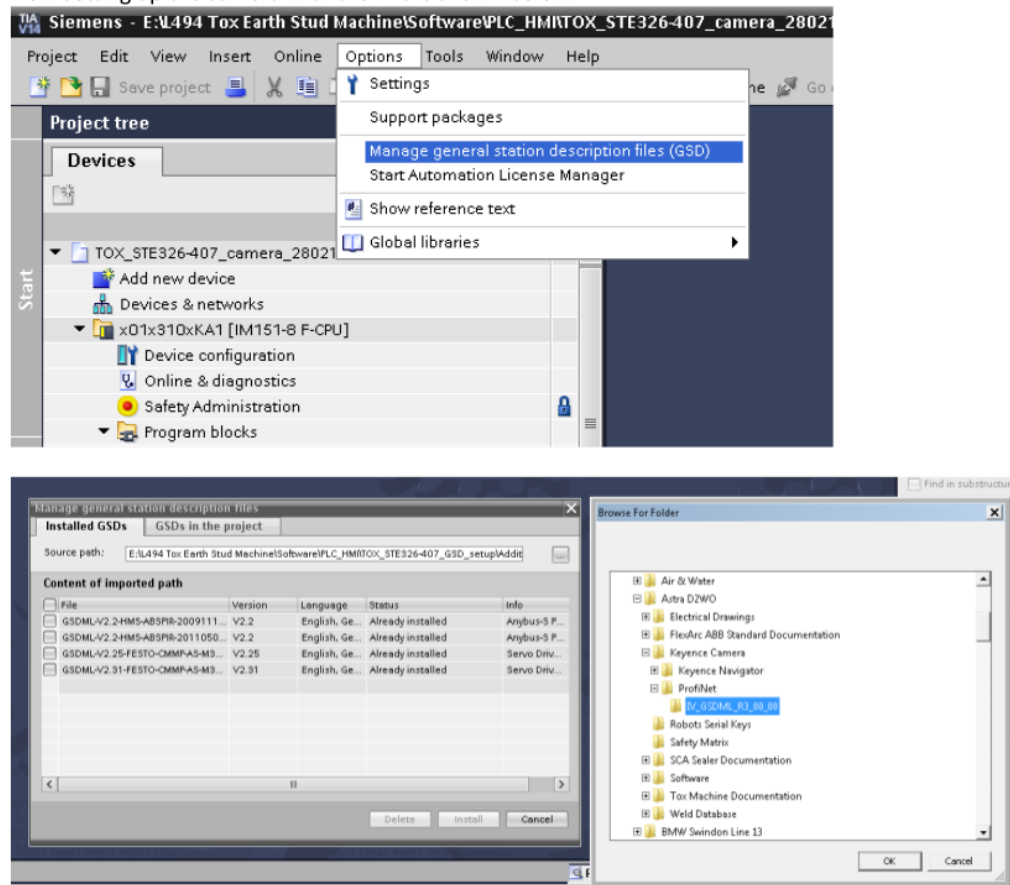
A good diagram showing the location of the test area

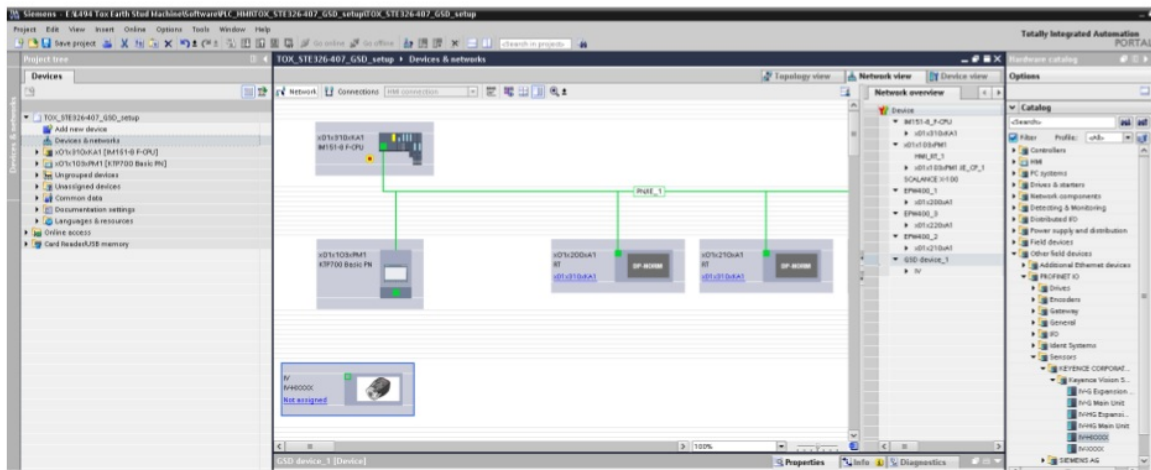
From the layout as well, the best place for the smart camera would be at the end of line conveyor. After the camera has a place it can be mounted the next step was to program the camera to pick up and sense the part. This involved the camera to be integrated with the Siemens PLC used on the cell

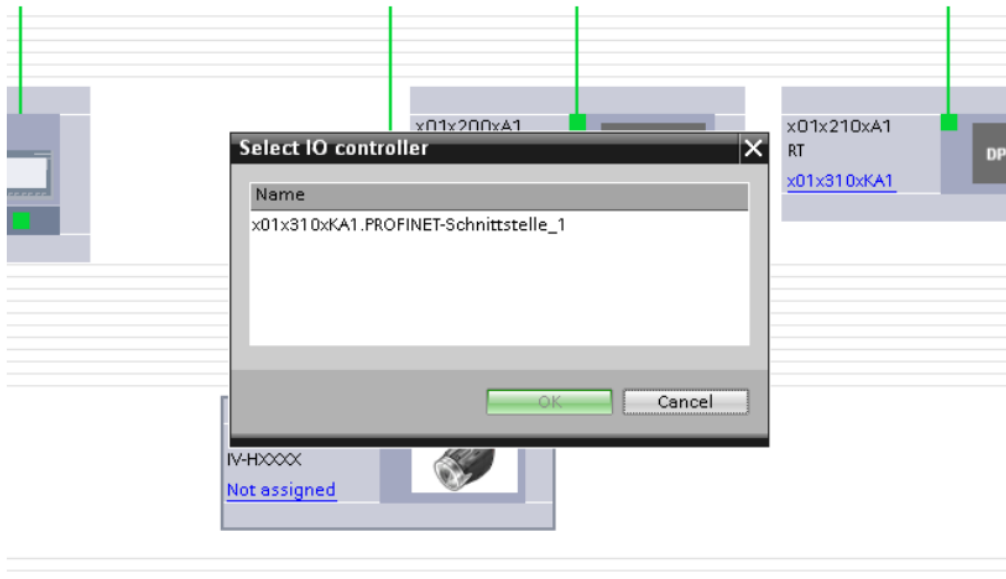
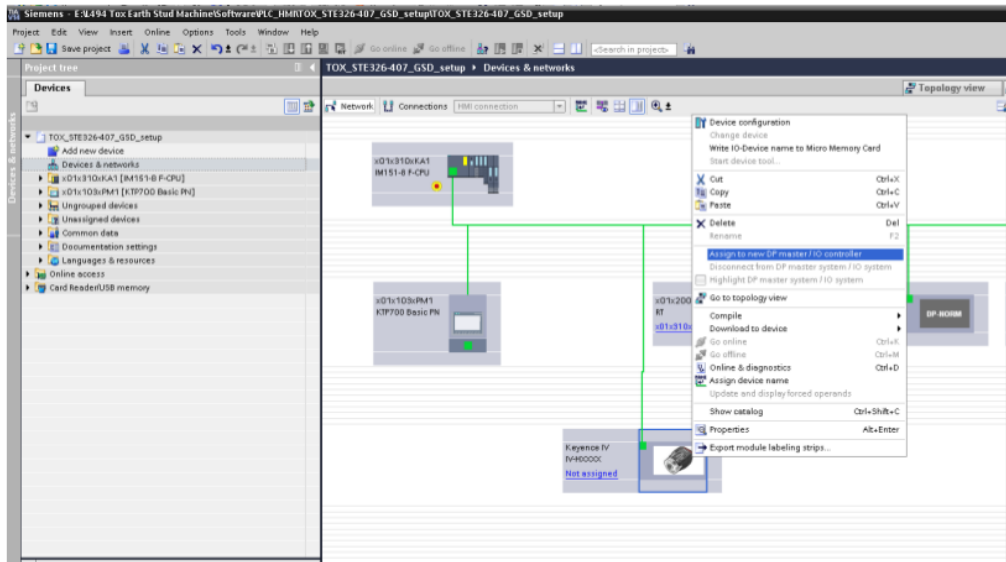
currently. Setting up the PLC is the biggest part for this project, making sure the camera is set up to detect properly and not only that linking it to the PLC.

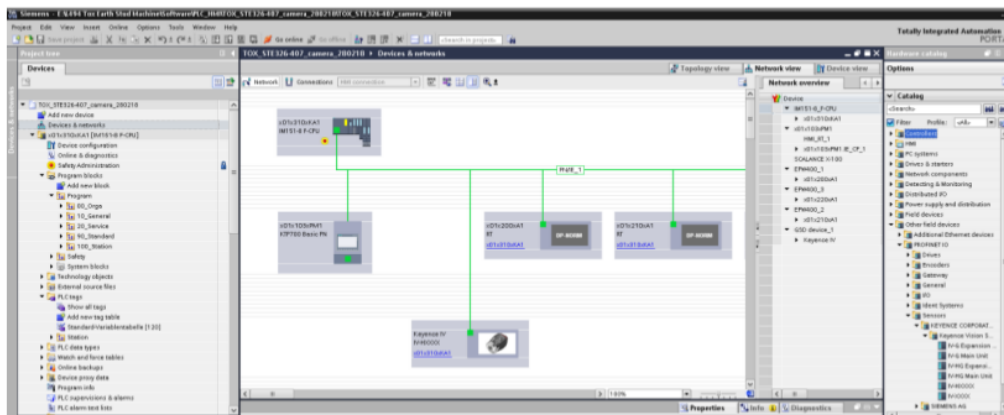
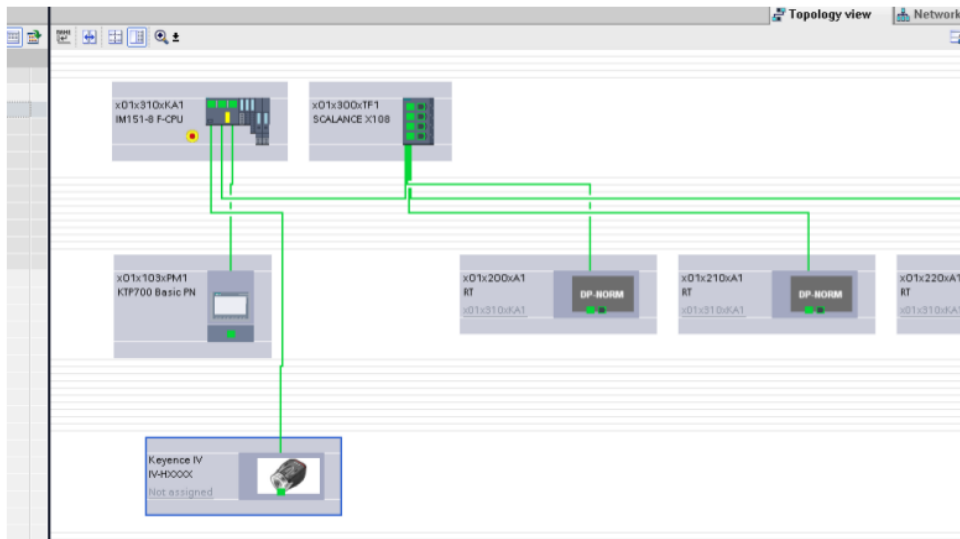
Once the camera was able to detect the part, the camera needed to be mounted but on a place on which it can detect the part needed, this involved a slight trial and error, it needs to be taken into account of the movement from vibrations by weld points and the robotic movements being carried out. Once the camera was detecting the part, linking it up with the PLC used on the cell currently needed to happen, a slight alteration to the program would need to happen, most likely in the cell safety so that the camera is able to send its results back. If there would be an issue then the line should stop with a fault, the fault should say and show that the camera isn't detecting anything. After the parts and camera have been checked and the problem resolved, the line can then be reset and the production can carry on.

Now setting up the camera with the PLC is shown below.









Now the camera has been set and has been tested to pick the part up it was ready to set it up in the cell to get it running. With everything needed for this solution a cost list was made in the presentation, an image of the cost will be shown below.

Solution 1 - costs

PLC - £2188.39

Lights - £73

Sensor - £50.91

Sensor cables - £10

Camera - £800

Total = £3122.30

All together, this has come to £3122.30.

Images show the evidence of the camera setup with the PLC

Solution 2



The second solution would take the same concept but adapt it so that the part would have to be moved off the line into a mould of the part and there will be various sensors in which the part could be detected by. Since there were already moulds of the parts to be checked against adapting it wouldn't have been a huge change. This solution however, has a number of issues with it. The first issue is the cost, compared to solution one, the cost is slightly increased due to all the sensors and sensor cables. Another big issue is the time wasting. For an operator to move the part from the end of like conveyor to the testing station, to then repeat this action it will stop the line from running as freely and would work and run a lot smoother with solution one. The costs and idea concepts are below from the PowerPoint created.

Solution 2 - costs

Lights - £73

Sensor - £50.91

Sensor cables x4 - £40

Camera - £800

Total = £963.91

A valid argument which seems to be the original method being used before the smart camera project. There are other technologies available which can perform the same function using less expensive cameras.

From the PowerPoint, the cost list has been taken into account again. Although solution 2 is a lot cheaper than the first solution, the idea of it will only cause more issues for the cell and the production time, which is already an issue. This is why solution was better than solution 2.

Solution 3

The third solution wasn't looked into greatly however, if it was to outweigh the second solution and the first solution didn't run so smoothly or anything then the third solution would back these up. The third solution is using an OPC server. OPC is an open platform communication and is set up and best used for client/server type of communication. The way this works is by changing the standard hardware communications and convert it to read it in OPC communications. This can also work the other way around as well. With how Morden and up to date this OPC is, it isn't going to help in the situation that the cell was in. With the issues and problems that are happening, this wouldn't solve the problems as best as the first solution.

This is another option for connecting an external device to the PLC of the job

Testing plan and procedures

Before placing the camera on the line, due to the urgency of the job it wasn't tested for this assignment it was tested to see if till it would pick up the part up. The plan was to take it off the line in the week of the 23rd March, however, due to covid-19 the factory had shut down production. Since there has been no workers in and no way to test the camera the table of results are hypothetical results. Due to the camera being on the cell and running, the main features can be seen to be working, however, extra tests that I wanted to do for the project will be hypothetically carried out.

The explanation here is poor

Type of Test being carried out.	What's meant to be the result.	Pass or fail.
1 - The camera can detect the small part being looked for on the bumper.	Once the camera is set up the camera should pick up the part and feedback to the PLC the result.	Pass Cell has been running with camera installed.
2 – test the PLC to see if the camera is feeding the signal back to it.	Once the camera has picked up the part the PLC should get a signal to say whether it is a pass or fail.	Pass Cell has been running with this system in place.
3 – Test various objects of different length, size, diameter and with lettering on it as well.	The camera should be able to detect the different objects after being set up.	Hypothetically yes it should be able to with no issues.
4 - While on the cell, if the camera doesn't pick up the part the red light should go off.	If there is an issue that the camera has not detected the part then the red light should go off and cell should stop production.	Hypothetically it should have been able to carry out this task seen as it's integrated into the PLC system.
5 – An error message would need to be made for the camera failing.	If the camera has got a problem an error message should pop up with what the problem is.	Hypothetically if the error message was added for the camera and the camera had failed then the error should work.
6 – trying the camera at different points in the cell.	The camera would be moved about to see if where it is now is the best place for it.	Hypothetically I don't think the camera would be better off anywhere else but since the testing couldn't happen then this test would be unknown.

Good to use the table but some of the tests are not clear

From the testing table, test 1 and 2 that were carried out can be confirmed as testing because this system has been on the line for some time and has been running well. The other tests however were tests I wanted to carry out but due to the working situation as mentioned above, these tests never happened.

Along with the Gantt chart the log books are another way in which the progress could be monitored. There is around 30+ log books for the this project, all of this time has accumulated to around 125 hours. The log books will be sent with this report to back up and issues or provides proof that the project was carried out with weekly updates.

Project specification

The project was being carried out, as previously mentioned, because of the amount of waste that the cell was producing. Currently apart from operators checking the parts there is no safety features, or no features in place that can pick up if the part is actually there. That's where the whole project has originated from. The biggest issue would be operator error by not checking the parts, the cell needed a design in which the parts where already being detected so the operators didn't need to worry as much. With this solution the idea of less wastage from the cell, less downtime to the cell is two big points which should improve from the solution chosen for the cell.

The camera fitted must pick up that the part is attached to the bumper, if there is no sign of the part then the cell should be stopped with an error warning. This would call maintenance over normally but if the operator can see that the part is missing, they should be able to overcome the issue with the cell. This means that the maintenance don't need to come over and possibly could avoid huge amounts of downtime on the cell.

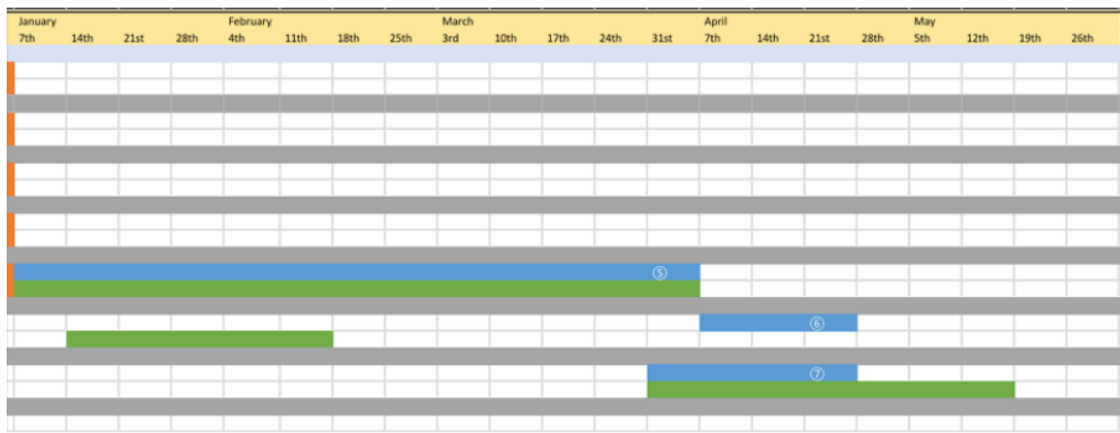
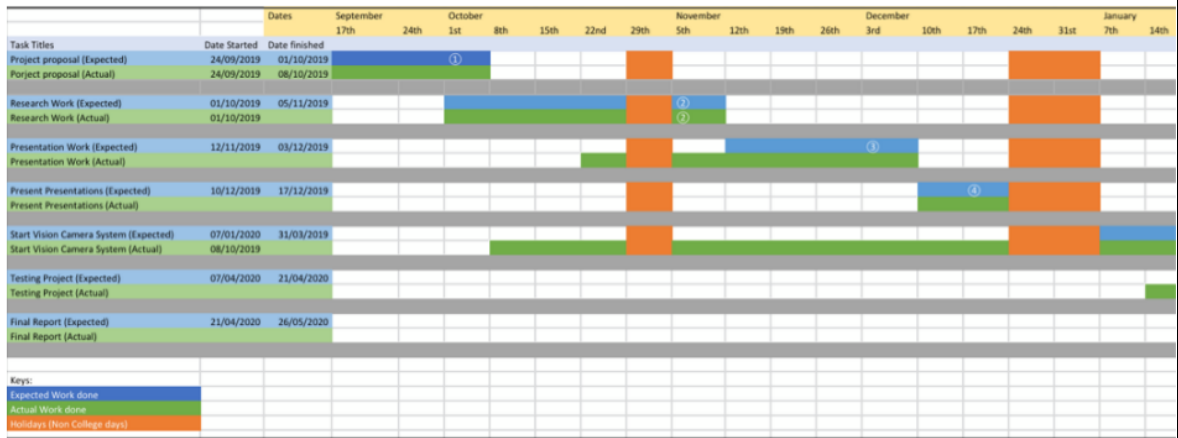


*This section
should be near
the beginning
of the report*

Above is the image of the camera being used.

Project plan

Thought the project, which started back at the end of September, a Gantt chart was created to track the progress of the project. This gantt chart has been updated weekly to match to the logbooks. This carried on until the final report of the project. The Gantt chart is shown below.



As shown above with the Gantt chart, it shows that most the milestones have been reached in time. Milestones 1, 2, 3, 4 and 5 were all met within the time it was stated/ predicted that these would be met. However, what is also shown that many tasks are started early compared to the actual start date. This is shown mainly with the building of the project. It was predicted that the building of this would start back in the new year, this was the same for the testing but due to the demand on finishing the project for work, it was rushed and therefore has been finished and started months earlier. The mile stone 6 was technically not reached. Where the tested started, it was only basic tests to get it ready for the line, the other tests that I wanted to carry had to wait until the line could be down. But also needed to Scott to assist when it came to the testing, due to him being in different shifts this made it difficult. As mentioned previously when the testing was meant to happen the workplace shut down due to covid-19. The project report has run along a bit longer because of the situation currently going on.

Gantt chart shows the comparison timelines and discrepancies.

Project discussion and conclusion

This part of the report, the three different solutions that were chosen for the initial issue will be discussed mainly to show the advantages and disadvantages of each solution and show why the first solution is the best one to use for the problem.

Solution 1 review

The first solution was the best one to choose, this was the easiest way to modify the cell and help solve the problem the best. Since the camera was installed the cell has had less issues with the parts damaged, missing parts etc, there are still issues but most importantly for all these issues with the parts the downtime has gone down as well.

The camera doesn't need a load of maintenance carried out on it, as it's a stand alone mounted camera it can be easily tested when the cell is down and is covered and slightly protected from the dust and ash for the welding points in the cell. The biggest issue that might arise from this would be the lenses being cover with some form of dust which could prevent the part being detected.

This is a fair point

Now the next part is to move onto the advantages and disadvantages of the solution, first the advantages will be discussed.

- . Easy to set up, easy to understand and easy to maintain.
- . Set up to PLC is easy and very little amount of wires needed.
- . Downtime is less while also making wasting parts less as well.
- . Makes the cell run smoothly as if there are any issues the PPC is I'll pick it up.

Now the disadvantages.

- . The cost of the solution is the most expensive.
- . Something could block the view of the camera

The main advantages and disadvantages of solution 1 has been discussed and as you can see there are a lot more advantages to using this solution, they outweigh the disadvantages.

Solution 2 review

Since solution 1 was very heavily invested in and looked into nearly instantly, looking for a second solution to back up the first in case something went wrong was difficult, however, making a sensing table was an idea to do the same sort of job but without a camera. Like the other solution the advantages and disadvantages of this solution will be discussed and at the end state an opinion for this method.

The solution would involve taking one of the moulds of the bumper and changing it into a sensing table for the part itself. This images has been shown below.



So with this idea again, the advantages and disadvantages will be covered. First the advantages.

- . The cost is a lot cheaper than solution 1
- . Easy to plan around

Now for the disadvantages.

- . Human error for the way they could plane the parts in.
- . More time will be taken to move the part from the end of line conveyor to the sensing bench
- . A lot more cables, easily damaged.
- . More maintenance required to keep it running.

From reviewing the solution this is not the best to use at all. Although it is a lot cheaper than solution 1, the way in which it would run would be no good for the cell with the existing issues.

Solution 3 review

From looking at the third solution, it was decided that solution 1 would be the best option for the project. Although because of this the solution wasn't research into as much, basic research such as what the OPC is and how this works was looked into but with the costs and other factors it was a lot simpler to go for the first solution. However, in future projects the OPC could be considered rather than the first solution.

*OPC server is not a viable solution
as it is a means of passing data*

Final decision

The decision was made for solution 1 because compared to the other two due to the advantages and disadvantages of all of them. Although the first one is the most expensive it can be shown that the way it runs and how it works will be more beneficial with all the issues it's meant to overcome. This project will be used more and has already been discussed about using it with other lines to resolve same types of issues.

between devices

Testing results and modifications

The testing results can only be shown in the cell working due to issues arising that haven't allowed the other tests to take place. The testing table used in the previous task would stay the same because these tests weren't able to be carried out. However, hypothetically modifying the project can be done. Since the testing hasn't been fully completed, it makes it hard to prove what could work better but to discuss it could prove a point.

The first modification I'd make is to place the camera in a position where if the part is damaged or the part is missing, you would only be having one part wasted rather than 5-6 that have already been placed in the cell and have already gone through the welding procedures. Another modification I'd like to make, it was part of the testing, was the lights. With all these cells and lines the lights will indicate if there is an issue with the cell. Having the camera fail, the light going off would be a good indication that but having an error message to state what the problem is will not only help maintenance if the camera has got a problem but will also help the operator know what the problem is and if it's an issue with the part it can be easily resolved, this therefore eliminates the downtime that is happening.

*There are valid
recommendations in
this section*

Discussion and conclusion

To conclude this project, to start the project was successful. However, when the project was first brought up, this job was a high priority in the workplace, so shortly after Christmas the camera was set up and me and the engineer I was working with, Scott, needed to quickly set it up, tested it and then fitted in on the cell while it was down for maintenance. Also because of the need for this project the camera couldn't be tested further until a later date, so all the tests that haven't been done have been hypothetically tested, the testing table is above and shown in this report. The week which the further tests were meant to take place was the of the 23rd March. However, due to covid-19 the workplace was shutting until it was safe to go back to work after lockdown. This meant that the project couldn't be tested further. With this being the issue the program to cell is also in the workplace and no testing and fault finding could be carried out, this meant that the testing and fault finding table above is again hypothetical answers on what I believe that the behaviour of the camera would be.

Apart from the covid-19 issue, there weren't too many issues at the start of the project. The only real issue that was encountered was the shift pattern. Since me and the engineer were on different shifts, he was on two shifts and I'm on three shifts, we would only be on the same shift two weeks out of 6-8 weeks. This was only an issue when it came to mounting and fitting the camera on the cell as the engineer needed to be there for assistance and to watch that the camera was being set up properly. The testing and setting the camera for the part was done on the work bench. The distance and the placement of the camera was gathered which made life easier when it came to fitting it into the line.

However, the main project goal and specification was met and all in all the project was successful. It's been running on the line for some time with the basic tests carried out, there hasn't been any major issues to do with the camera not working or the camera isn't sending a signal back to the PLC. The testing that was done was successful and how the camera should have been functioning, it worked really well when comparing it to the documents that were sent with the camera. Along with the project being successful and working it has taught me important points to consider if and when this task is needed again. I've learnt how the camera can be used and utilised to detect anything needed, whether that be a small marking, or an object that is needed on the part, and also it has opened my eyes on how this can be integrated with a PLC. I didn't realise how easy it was to link with a PLC and how useful this would be. Along with the practical aspects that I've learnt it has also given me a great understanding for time management on an actual work project and most importantly it shows how anything can happen. Back when project was started I thought the project would go smoothly, issues can come up which could put a stop to the job or put it on hold for whatever reason, this could be out of control but yet the project was still successful.

If this project was needed to be done again, I would need to test it better and make sure that the tests I want to carry out have been done before it goes into the line. The Gantt chart is a really good reflection on how the project went. As it shows what happened throughout the year and what dates different tasks were started.

FINAL GRADE

GENERAL COMMENTS

Instructor

35/100

PAGE 1

Text Comment. Word count is missing

PAGE 2

Text Comment. The contents list can be subdivided to give more details

PAGE 3

Text Comment. Avoid first person terms

Text Comment. A good reference to log books

Text Comment. The problem is defined

PAGE 4

Text Comment. Good supporting image of the problem

Text Comment. There is clearly research carried out, but there are no supporting sources for this.

PAGE 5

Text Comment. These are good images but the research for this must be supported.

PAGE 6

Text Comment. What is the source of this information about the camera

Text Comment. The images show that the camera is capable of processing images for details using a masking method and region of interest ROI.

Text Comment. The images show the camera can capture small detail and do an analysis using a measurement tool.

Text Comment. Good argument and image of this possible solution. No reference sources included.

Text Comment. A good diagram showing the location of the test area

Text Comment. Images show the evidence of the camera setup with the PLC

Text Comment. A valid argument which seems to be the original method being used before the smart camera project. There are other technologies available which can perform the same function using less expensive cameras.

Text Comment. This is another option for connecting an external device to the PLC . It does not do the image processing.

Text Comment. The explanation here is poor

Text Comment. Good to use the table but some of the tests are not clear

Text Comment. This section should be near the beginning of the report

PAGE 18

Text Comment. Gantt chart shows the comparison timelines and discrepancies.

PAGE 19

Text Comment. This is a fair point

PAGE 20

Text Comment. OPC server is not a viable solution as it is a means of passing data between devices.

PAGE 21

Text Comment. There are valid recommendations in this section

PAGE 22

GRADING FORM: CSG-RUBIC

JONATHAN PULMAN

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RESEARCH-INFORMED LITERATURE



The background research carried out is very informative. The research of solutions for the project should be supported with relevant sources. There are no sources to support any research carried out. 4/10
No sources used. 0/10

4/20

KNOWLEDGE AND UNDERSTANDING



Specification is more of an explanation and is not very clear of what the requirements are. Poorly put together. 3/10 The solutions considered are the final solution which should be supported with relevant sources from the research. You have an alternative solution which is an original method, but there should be more detail on this and an example to support your argument. The third option (OPC) is not a viable option. 4/10

7/20

ANALYSIS



Testing and results are hypothetical and only the predicted outcomes are recorded. Some of the test stages are not clear. 3/10 Conclusion and recommendations make a relevant point. 6/10

9/20

PRACTICAL APPLICATION AND DEP.



Planning with the use of a Gantt chart and a comparison timeline is clear. 3/5 Final solution considered has been explained but the alternative solution needs an example and more detail to support your argument. The third solution is not a viable alternative. 4/10 The system has not been implemented and is missing the PLC program and smart camera script. Only the camera and PLC setup has been carried out. 3/10

10/25

SKILLS FOR PROFESSIONAL PRAC.



Even though there are good points made, the quality of the report is poor. The grammatical errors are extensive throughout the report.

5/15