Student Information

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Discipline: Electrical Engineering

Department: EGA-C

Group: ED (Electrical Design) Block

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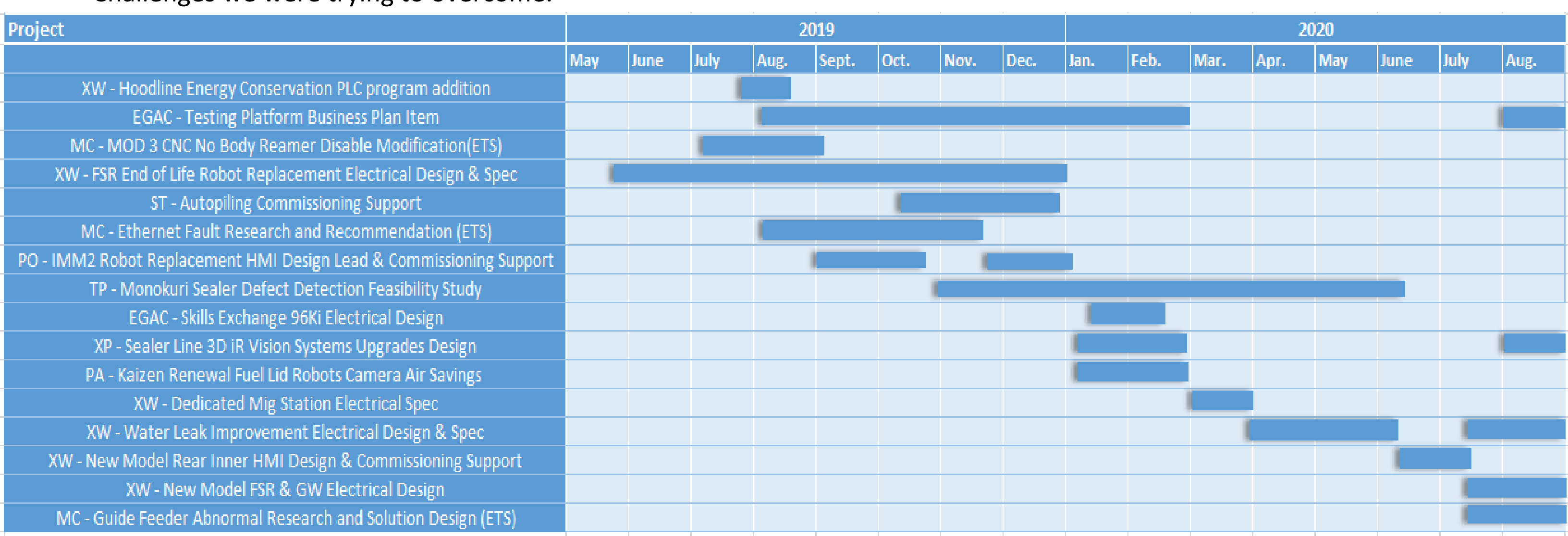
High Level Summary

My experience is heavily focused on the technical aspects of the business and I frequently took on informal leadership roles within teams of peers (Students/EDPs) by guiding the group through a superior understanding of the Technical Challenges we were trying to overcome.



Recommended Improvements for the Internship Program

I felt that I had to be extremely resourceful to gather the necessary information at the start of my information to get started on my first few projects. This could certainly be eased by getting more dedicated mentorship from Full-Time members of the Block or from previous Interns. I ensured that the intern who arrived after me was well taken care of and received that transfer of knowledge in hopes of him passing it on to the intern after him. I frequently keep track of his progress, encourage him to take on more of my responsibilities and pass recommendations to him on how he can improve his performance to make the most of his time here.

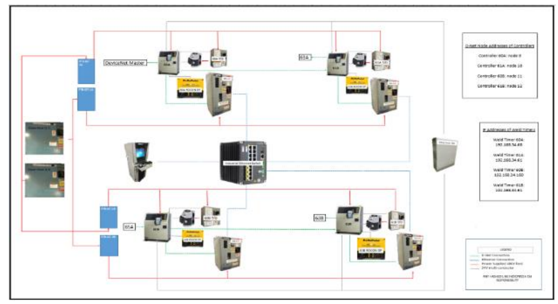
2.0 XW FSR End of Life Robot Replacement - PLC/HMI Programming & Hardware Design

Technical Summary: As the lead Electrical Designer I completed Robot Replacement Hardware Design changes along with appropriate PLC/HMI modifications for four Motoman Robots to be replaced by Fanuc Robots. I organized myself effectively and completed the project while using only half of the expected quoted hours.

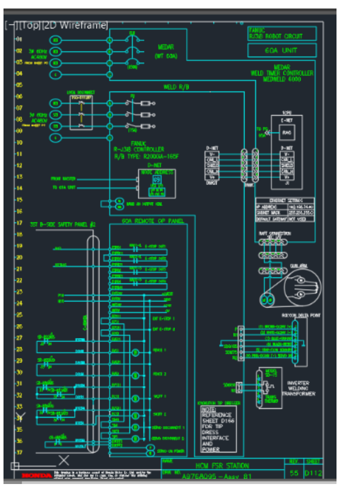
The project I have been most involved with was the End of Life Phase VI Robot Replacement Project, in which I was the lead electrical designer. It entailed replacing four spot weld robots 60A/B and 61A/B in Weld 2 FSR from XRC Motoman to redeployed Fanuc robots. Plant side's goal with this robot replacement was to improve cycle time efficiency, weld quality, and downtime. I was responsible for the PLC/HMI programming and Hardware Design for these robot replacements to ensure a successful install.

At the initiation of this project, I looked into the project targets and metrics and determined the design approach I would have to use. Next, I made note of the deadlines I was required to meet for the hardware, software design reviews, and the actual install dates, in order to manage my time. This would come in handy later as I beat the quoted Design Time by almost half through my extensive and time sensitive schedule keeping.

For this particular project I started by creating the Electrical Spec, before I even began the design work. I assessed the existing hardware schematics to familiarize myself with the cell. This required situational analysis through gemba, in other words, investigating and visiting the line to see the robot in action. I explored the line to see where the new robot controller would be located, where the controller power would come from, and explored the respective weld controller and tip dressers. I created a Line drawing to illustrate my understanding of the affected system and better communicate it to others.



Second page of Electrical Spec illustrating proposed layout 60AB & 61AB equipment

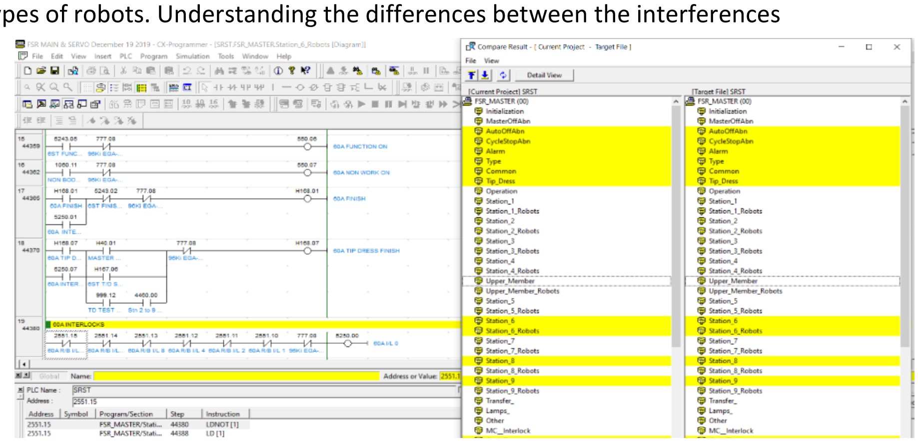


Example of 1 out of 52 modified drawings during 96 Ki EOL Robot Replacement

I also determined the ideal location to place the appropriate safety connections (E-Stop, Fence On/Off, Servo Off, and External Off) belonging to the new robot. When examining the safety panels, I assessed the space required and whether or not additional safety or control relays would be needed. This turned out to be a bit of a hassle due to the tight space in most of the nearby panels and the lack of budget to be adding panels. As a result, we came up with a creative and cost effective solution which involved daisy chaining safety signals between robots. During this exploration, I also updated hardware schematics to reflect the current lineside state of relays and used relay contacts. This is important in the event plantside ever faces a downtime event and is in need of the latest hardware schematics for troubleshooting.

The technical design of this project involved hardware, software, and HMI design changes. Hardware changes included the removal of old electrical connections and addition of new ones with respect to the robot controller, power distribution, and safety connections. I updated the hardware drawings to reflect the existing electrical connections seen line side, along with the changes made through the duration of this project.

There were a mix of Fanuc and Motoman robots. Due to this variety, I had to understand the programming for interferences between different types of robots. Understanding the differences between the interferences between a Fanuc and Fanuc robot, a Motoman and Motoman, and a Fanuc and Motoman robot was imperative for this job. After intensive research, I made an interlock and interference flowchart that outlined the changed interferences and interlocks of 60A/B and 61A/B along with all the robots it had interferences with during its cycle. Conveying this information in an organized manner helped me articulate these changes to the parameter team when teaching the robots, and helped me program the PLC efficiently. The last design portion was updating the HMI screens with the new I/O addresses, interlocks, interferences, and status bits.



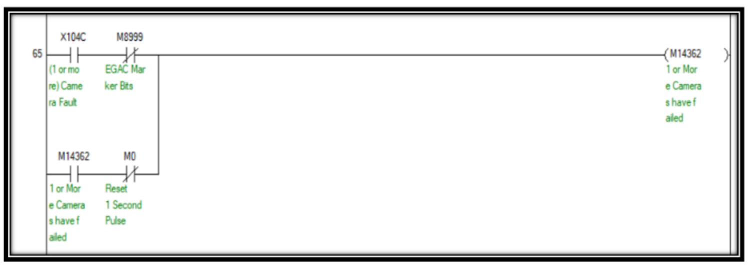
__Hundreds__ of modifications to the PLC program made during 96Ki EOL Robot Replacement, highlighted sections in the Compare Results Table show sections with modifications in them.

2.1 XP Sealer Line 3D iR Vision Systems Upgrades – 3D iR Vision System/PLC/HMI programming

Technical Summary: In a Kaizen partnership I upgraded the 3D iR Vision System at Sealer Line along with appropriate PLC/HMI modifications in response to Downtime. The modifications to the 3D iR Vision comprised of auto-contrast adjustment for the Vision System and an additional alarm sent from the Vision System through the PLC to the HMI. ETS Block valued this type of Downtime at $7,468.80 and was attempting to prevent this from happening again in coordination with ED (me).

In response to two different persistent sources Downtime in Paint 2 ETS (Engineering Technical Services) was looking to upgrade the Sealer Line 3D iR Vision Systems to eliminate these sources of Downtime. Even though I am a member of ED (Electrical Design) I was given permission to work on this project. My role in this project was the Programmer at which point I would hand off my work to an ETS associate who would at a later date implement the project.

The first source of Downtime was brought on by two or more of the four cameras in the 3D iR Vision System failing to detect the correct image. Typically, a double camera failure is preceded by a series of single camera faults which are simply ignored because the operator has no way of seeing this. By showing a Warning Alarm on the HMI when we are consistently receiving single camera faults, this provides us with a warning of a potential adjustment being required for our cameras by a Vision Systems Expert days ahead of any potential Downtime.



Pulse from Robot being treated as a Warning Alarm in convention with other Warning Alarms from across the plant.

```
!If this is a Ghost job, skip ;
!vision. ;
R[93]=14     ;
IF DI[8]=ON OR DI[65]=OFF,JMP LBL[999] ;
 ;
!robot to get new offsets. ;
IF DI[66]=ON,JMP LBL[10] ;
 ;
LBL[11] ;
 ;
//Proposed Addition to Robot Program
      VISION RUN_FIND 'Test 3D1'
      VISION GET_NFOUND 'Test 3D1' R[200] CAMERA_VIEW[1];
      VISION GET_NFOUND 'Test 3D1' R[201] CAMERA_VIEW[2];
      VISION GET_NFOUND 'Test 3D1' R[202] CAMERA_VIEW[3];
      VISION GET_NFOUND 'Test 3D1' R[203] CAMERA_VIEW[4];

      IF !(R[200]=0 OR R[201]=0 OR R[202]=0 OR R[203]=0), JMP LBL 22;

      DO[77]=ON;
      WAIT 0.5(sec);
      DO[77]=OFF;

      LBL 22
!Clear old offsets ;
CALL IRVCLRAL     ;
 ;
!Get the status of the IRVCLRAL ;
!operation ;
CALL GET_KVAR('IRVCLRAL','STATUS',91) ;
 ;
```

3D iR Vision System program modification to send a pulse to the PLC when any single camera fault is detected

The second source of Downtime arises from the fact that sometimes the CBU can be a little darker than normal due to over exposure in the Oven, thus the 3D iR Vision system struggles to recognize the image in front of it. To address this issue we provide the Operator with the option to cycle multiple attempts at capturing the correct picture by increasing the Contrast of the pictures taken. The reason the Robot Program can only adjust its contrast when the Operator explicitly tells it to do so is by design and not a bug. Plant side wanted to know when higher contrast was required to keep track of how often this problem would arise. The PLC program is not shown for this section as it is a simple input.

```
WAIT    .50(sec) ;
DO[68]=OFF ;
 ;
WAIT   1.00(sec) ;
 ;
IF DI[65]=OFF,JMP LBL[999] ;
 ;
JMP LBL[11] ;
 ;
LBL[10] ;
 ;
!Get vision offsets. ;
LBL[21] ;
 ;
IF DI[65]=OFF,JMP LBL[999] ;
DO[65]=ON ;
DO[66]=ON ;
 ;
 ;
WAIT    .50(sec) ;
 ;
//Proposed Addition for Objective 2
      //<R[204] needs to be set to some lower value, no counter associated with it yet>//ac
      IF DI[67] = OFF, JMP LBL 12;
      R[204] = R[204] - R[204]*0.05;
      VISION OVERRIDE 'NAME1' R[204]
      VISION RUN_FIND 'NAME2'
      VISION GET_OFFSET'NAME2' VR[1]
      JMP LBL 999
      <Vision Process:'NAME2',
      Vision Tool: Specify whichever GPM Locator Tool we are overriding,
      Property: Contrast Threshold Value>
      LBL 12
CALL IRVGETOF('Stage1',1) ;
 ;
!Get the status of the IRVGETOF ;
!operation ;
CALL GET_KVAR('IRVGETOF','STATUS',91) ;
 ;
```

3D iR Vision System program modification to auto adjust contrast when CBU not detected and Operator sends command

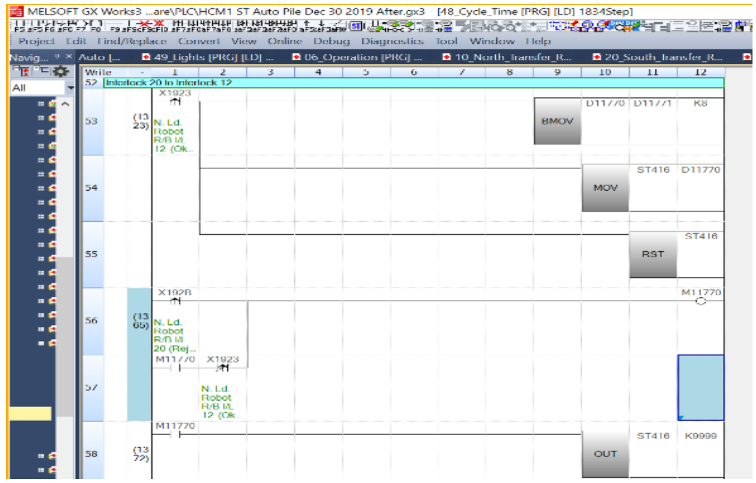
I completed all of my research in the area of 3D iR Vision systems through a series of manuals, Youtube tutorials and minimal supervision from an ETS full-time associate and was easily some of the more difficult research I had to do. I often contacted FANUCs iR Vision department to confirm my understanding and explaining my logic to them as well. This was amazing technical experience for me and I thoroughly enjoyed the challenge.

2.2 Winter Shutdown Commissioning Support @ ST Auto Piling & PO4 IMM2– PLC/HMI Programming

During the 96Ki Winter Shutdown I was assigned to two different projects. One of the tasks was to assist the Commissioning of the Auto Piling project in Stamping. Among many other tasks I took on at the site I completed the three following tasks.

Cycle Time: PLC/HMI programming

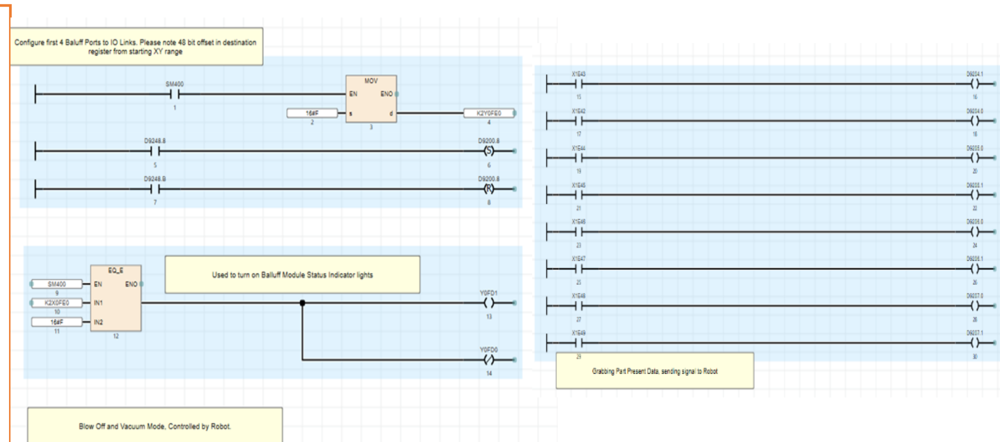
I wrote the section of PLC program that dealt with Cycle Time. I reserved Timers, then used them to record the interval between relevant interlocks. I proceeded to capture and illustrate this information on the HMI. The Cycle Time screen was used consistently by other Designers assigned to this project to deal with Cycle Time issues that arose later on during the build and commissioning process, specifically Robot Teaching.



One of 40 recorded interlock to interlock intervals that I captured in the i-QR series PLC and showed on the GOT, approximately 230 lines of PLC programming, only 5 lines shown here.

Vacuum Pump Setup: Research/PLC programming

I researched an unusual Vacuum Pump that is only used in Stamping, while allowing for far more control of air pressure, hysteresis and other factors. After researching the pump, and seeing how it's been programmed previously throughout Stamping with Function Blocks from older PLC's that we couldn't copy or see inside of, I recycled the old code in a format that worked for the i-QR PLC to control these Vacuum Pumps through a CC-Link Remote IO Balluff Module when a signal is given by the Robot to the PLC.



Sample of program written to control Balluff modules through CC-Link IO modules, when approriate signal is given from respective Robot to the PLC.

GOT Assist: HMI Programming/Scripting

I modified the HMI at Stamping Auto Piling and completely redesigned the HMI at PO IMM2 Robot Replacement during the 96Ki Winter Shutdown. At PO4 IMM2 I did a complete re-haul of the Screen Design and sent the template to Plant side for them to implement for IMM1, 3 &4 on their own time. I coordinated with Contractors and Designers to appropriately allocate bits that I wanted to show on the HMI. During this design process I also got the opportunity to do some scripting to create a single page scroll feature for aesthetic appeal (approximately 400 lines).

```
//===== IMM#2 RB I/O Monitor Script =====

//Current HMI Page number
//GD188 - Page dedicated to one robot set by the screen switch button
//GD200 - Device status
//GD150 - Holds Comment Group Number, calculated value
//GD210 - Holds Comment Number in the Group, calculated value
//GD191 - scrolling device within page
//GD400-GD440, GD450-GD490 - Temp buffer storage for the whole range of 4 words

// HMI Now Page Number for Address name file number and Comment file number
[w:GD 150] = 100;                // GD150 = PLC-R/B In Address Number;
[w:GD 151] = 101;                // GD151 = R/B Out Number
[w:GD 152] = 102;                // GD152 = R/B Out Comment
[w:GD 153] = 103;                // GD153 = PLC-R/B Out address number
[w:GD 154] = 104;                // GD154 = R/B input
[w:GD 155] = 105;                // GD155 = R/B In Comment

//IO Monitor Page Number Reset when another screen pressed, GB42
if([b:GB 42] == 1)
{
        [w:GD 191]=1;
        [b:GB 42] =0;
}

//IO Monitor Page Number Range Check
if([w:GD 191] < 1){
        [w:GD 191]=1;
}

if([w:GD 191] > 4){
        [w:GD 191]=4;
}


// X AND Y INPUTS MOVED INTO INCORRECT RANGES THOSE COMMENTS ARE PROBABLY BLANK

bmov([w:X 1140],[w:GD 400],4);
bmov([w:Y 1140],[w:GD 500],4);
```

```
//I/O Lamp Status PLC to GD address
switch([w:GD 191]){
case 1:
[w:GD 200]= [w:GD400];
[w:GD 300]= [w:GD500];
break;
case 2:
[w:GD 200]= [w:GD401];
[w:GD 300]= [w:GD501];
break;
case 3:
[w:GD 200]= [w:GD402];
[w:GD 300]= [w:GD502];
break;
case 4:
[w:GD 200]= [w:GD403];
[w:GD 300]= [w:GD503];
break;
}


//PLC IN address name display
[w:GD 210]=([w:GD 191]-1) * 16 +1;
[w:GD 211]=([w:GD 191]-1) * 16 +2;
[w:GD 212]=([w:GD 191]-1) * 16 +3;
[w:GD 213]=([w:GD 191]-1) * 16 +4;
[w:GD 214]=([w:GD 191]-1) * 16 +5;
[w:GD 215]=([w:GD 191]-1) * 16 +6;
[w:GD 216]=([w:GD 191]-1) * 16 +7;
[w:GD 217]=([w:GD 191]-1) * 16 +8;
[w:GD 218]=([w:GD 191]-1) * 16 +9;
[w:GD 219]=([w:GD 191]-1) * 16 +10;
[w:GD 220]=([w:GD 191]-1) * 16 +11;
[w:GD 221]=([w:GD 191]-1) * 16 +12;
[w:GD 222]=([w:GD 191]-1) * 16 +13;
[w:GD 223]=([w:GD 191]-1) * 16 +14;
[w:GD 224]=([w:GD 191]-1) * 16 +15;
[w:GD 225]=([w:GD 191]-1) * 16 +16;
```

This script was written to provide a scroll feature for the Robot IO at IMM2 in PO, the full program is not shown. Fun learning experience!

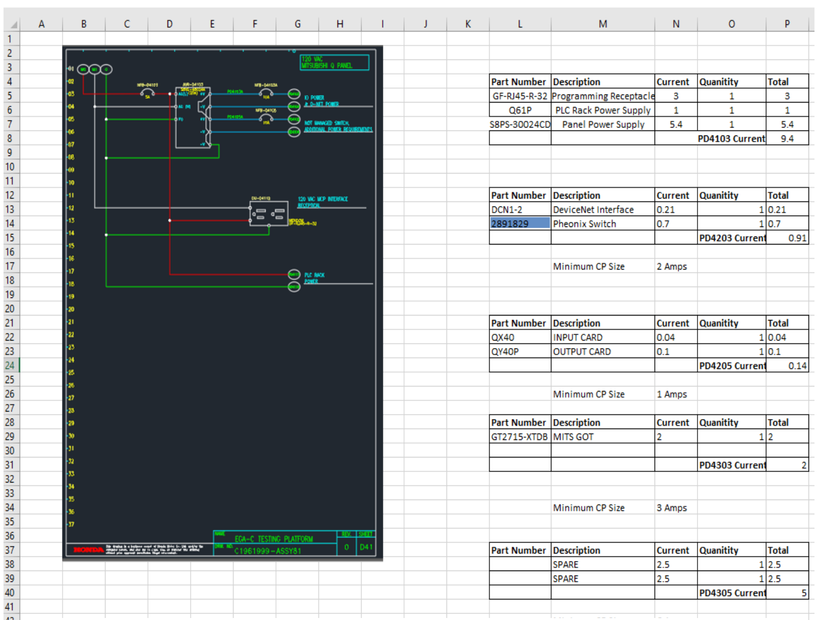
2.3 EGAC Testing Platform – Business Plan Item – Hardware Design, Manufacturing, Project Management & Mentorship

I designed and manufactured a series of easy-to-transport testing platforms for Omron Control PLC, Mitsubishi Control PLC, Allen Bradley Safety PLC & Mitsubishi GOT. I also used this project to sharpen my Project Management and Mentorship skills. I actively maintained schedules to help me organize the project design time, order time, lead time and build time in a cost effective and time efficient manner.

Allen Bradley SPLC Testing Panel

There are plans in the future to keep creating these Testing Platforms. Thus, I have created a rough costing plan and spread it out over multiple Ki's. Every effort has been made to reduce the cost per Testing Platform, I even scavenged a lot of these parts from the EGA-C shop to reduce cost significantly.

Throughout this design process I focused intently on what would make this product useful, safe and easy-to-use for the Customer. I asked for the input of many ED/EM/ETS full-time associates as to what they would like to see in these Testing Platforms to get a wide range of ideas and utilize their experience. I used AutoCAD & Excel rigorously to conceptualize, plan and explain my ideas to my G/L and actively sought out the opinion of all potential customers. I followed the most updated version of the Honda Drawing standard and template as laid out by EGA in all of my CAD drawings.



Part Number	Description	Current	Quanitity	Total
GF-RJ45-R-32	Programming Receptacle	3	1	3
Q61P	PLC Rack Power Supply	1	1	1
S8PS-30024CD	Panel Power Supply	5.4	1	5.4
			PD4103 Current	9.4

Part Number	Description	Current	Quanitity	Total
DCN1-2	DeviceNet Interface	0.21	1	0.21
2891829	Pheonix Switch	0.7	1	0.7
			PD4203 Current	0.91

Minimum CP Size 2 Amps

Part Number	Description	Current	Quanitity	Total
QX40	INPUT CARD	0.04	1	0.04
QY40P	OUTPUT CARD	0.1	1	0.1
			PD4205 Current	0.14

Minimum CP Size 1 Amps

Part Number	Description	Current	Quanitity	Total
GT2715-XTDB	MITS GOT	2	1	2
			PD4303 Current	2

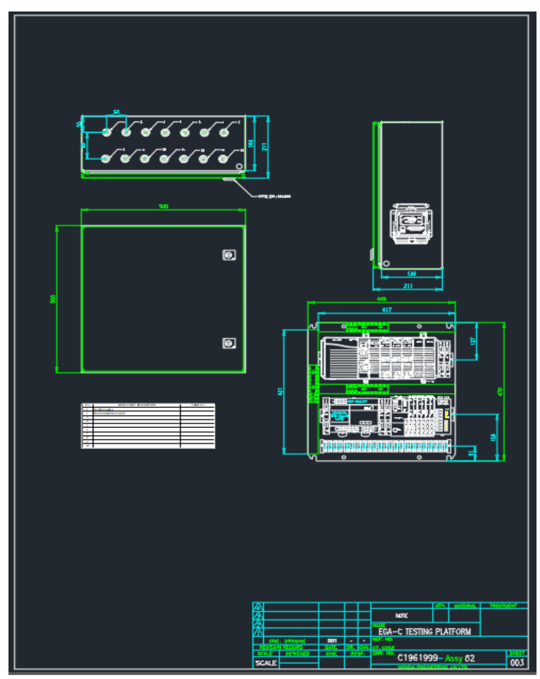
Minimum CP Size 3 Amps

Part Number	Description	Current	Quanitity	Total
	SPARE	2.5	1	2.5
	SPARE	2.5	1	2.5
			PD4305 Current	5

Power Calculations completed for the Testing Platforms Power Distribution, these calculations provide the minimum NFB and CP size

Typically, after completing a Hardware Design I hand my drawings off to EM (Electrical Manufacturing), but by carrying the project through the whole process on my own I learned a lot about translating my theoretical drawings from paper to real, applied products. I made sure that all of my panels were CSA compliant, by grounding properly, implementing finger guarding and protecting against short-circuits using NFB's. I also completed Power Calculations on them to ensure that I was selecting the correct NFBs/CPs while supplying appropriate power to all devices. Needless to say with all that practice using power tools/designing safe and easy-to-use Testing Platforms, I cut down design/build time from a period of 2 months for the first panel to about 1 week for the last panel.

This project also served as a wonderful mentorship opportunity for the Junior Intern coming in after me, near the end of my Internship. I used this opportunity to explain as much as I could about AutoCAD Electrical, the CSA standards, power calculations and design process. We spent a lot of time working together on the newer Testing Platforms and I delegated a variety of tasks to him for the benefit of his learning. In particular, with power tools I gave him a solid introduction to them with safety always first and foremost in mind.



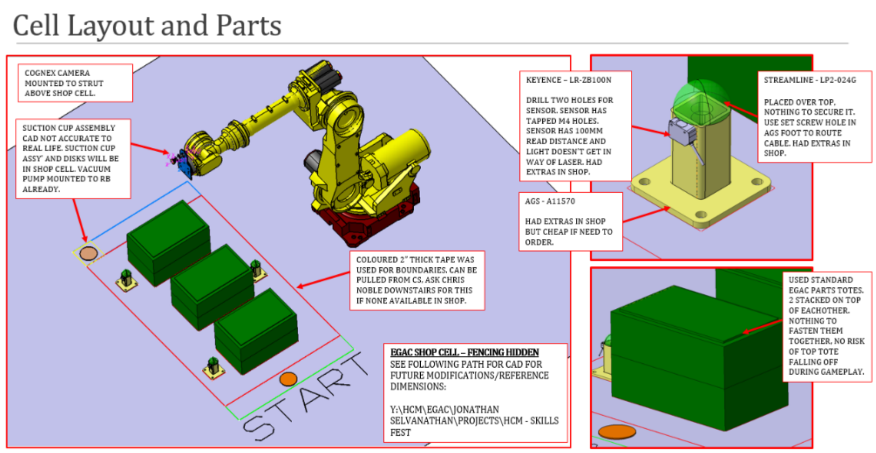
The AutoCAD Panel drawing of one of four Testing Platforms I designed (AB Safety Panel)

3.0 Skills Exchange Game Design – Fanuc Robot/Cognex Camera Programming & Hardware Design

Technical Summary: As the lead Electrical Designer I completed a Vision System & Fanuc Robot programming, using them in tandem to grade Player performance & to Automate the Reset process (ROBOT – VISION GUIDANCE) to decrease cycle time and increase rounds played. Limited Robot movements so as to prevent any possibility of faults during gameplay such as; Limit SW, Overreach, Collision (floor) & DCS faults.

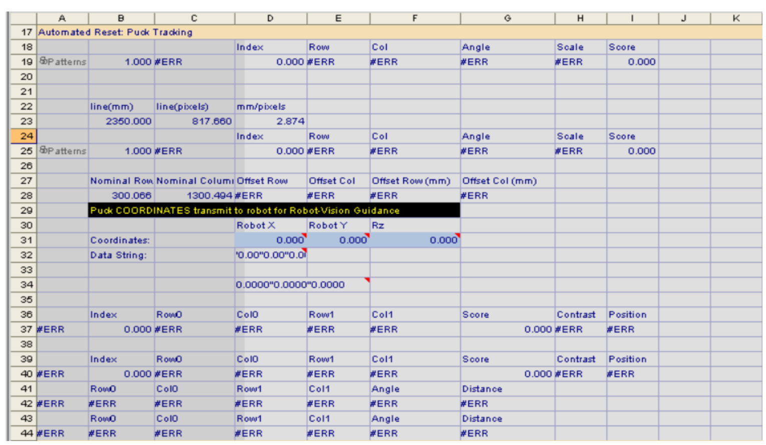
During the 96Ki Skills Exchange Challenge the EGA-C interns were challenged to create a game that was enjoyable to play. The three engineering interns split up the workload as if this was a regular EG Project along the lines of Project Manager, Mechanical Designer and Electrical Designer. As the Electrical Design Intern my entire responsibility was to program the Fanuc Robot & Cognex Camera while also completing the Hardware Design to power and allocate IO for field sensors and the Cognex Camera.

The goal of the game is to pick up a puck using the Fanuc Robot and move the puck over whatever light in the field was turned ON. When the puck is over the light a Part Detect senses the object and sends a signal to the Robot IO while turning off the corresponding light. After the light sequence, the puck must be placed in the center of a square at the opposite end of the cell. There are also obstacles in the cell which you must avoid bumping. The movement in the obstacles (caused by the robot bumping into the obstacles) is calculated by the Cognex Camera and gives a penalty to your final score. The Cognex Camera also grades how precisely you put the puck in the center of the square at the end of the game and this is the biggest positive contributor to your points, all factors to the overall score are calculated in the Robot and shown on the Teach Pendant. I limited the Fanuc Robot operation in a rectangular XY plane during Gameplay except when picking up or dropping off a part, to prevent Limit SW, Overreach and DCS Faults. I automated the pick-up and drop off processes to protect the End-Of-Arm-Tooling from slamming off the floor or clumsy suction activation, due to human error.



Basic Game Layout and Explanation

A major concern with this game was how long it might take to reset the cell after each round. I resolved this issue by using Robot –Vision guidance techniques to send the pucks location relative to the Robot from the Cognex Camera to the Robot and then telling the Robot to safely pick up that part and relocate it to the start location. Additionally, we did not need to reset the obstacles (in case they were bumped) because the Cognex Camera was comparing pics before and after each round and not comparing to some standard picture from many turns ago. By using the Cognex Camera & Fanuc Robot together to automate the Reset process as opposed to entering the cell and resetting all objects in the cell, I cut down the wait time to play our game significantly and provided a more enjoyable experience for the Customer.



	A	B	C	D	E	F	G	H	I	J	K
17	Automated Reset: Puck Tracking										
18				Index	Row	Col	Angle	Scale	Score		
19	Patterns	1.000	#ERR	0.000	#ERR	#ERR	#ERR	#ERR	0.000		
20											
21											
22		line(mm)	line(pixels)	mm/pixels							
23		2350.000	817.660	2.874							
24				Index	Row	Col	Angle	Scale	Score		
25	Patterns	1.000	#ERR	0.000	#ERR	#ERR	#ERR	#ERR	0.000		
26											
27		Nominal Row	Nominal Columi	Offset Row	Offset Col	Offset Row (mm)	Offset Col (mm)				
28		300.066	1300.494	#ERR	#ERR	#ERR	#ERR				
29		Puck COORDINATES transmit to robot for Robot-Vision Guidance									
30				Robot X	Robot Y	Rz					
31		Coordinates:		0.000	0.000	0.000					
32		Data String:		'0.00"0.00"0.0							
33											
34				0.0000"0.0000"0.0000							
35											
36		Index	Row0	Col0	Row1	Col1	Score	Contrast	Position		
37	#ERR	0.000	#ERR	#ERR	#ERR	#ERR	0.000	#ERR	#ERR		
38											
39		Index	Row0	Col0	Row1	Col1	Score	Contrast	Position		
40	#ERR	0.000	#ERR	#ERR	#ERR	#ERR	0.000	#ERR	#ERR		
41		Row0	Col0	Row1	Col1	Angle	Distance				
42	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR				
43		Row0	Col0	Row1	Col1	Angle	Distance				
44	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR				

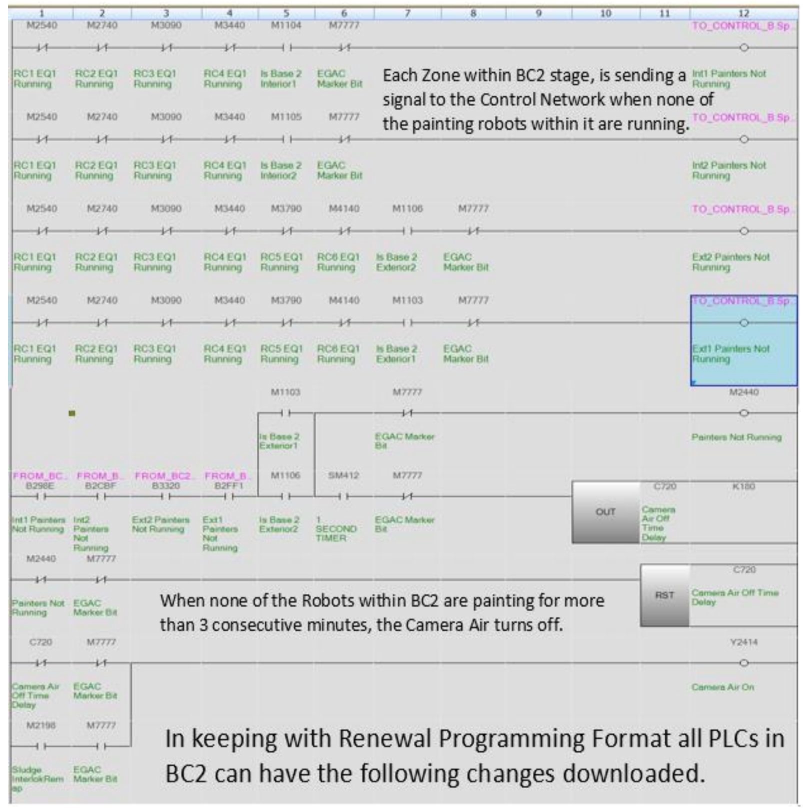
Snippet of Cognex Camera Program used to provide Robot with Vision Guidance

FANUC Robot Program shown in Notepad (LS file)

3.1 PA1 Renewal Fuel Lid Robot Camera Air Savings: Kaizen – PLC Programming, Teamwork

While I was completing One-Year Checks with the ETS team in Paint Renewal at BC2 Stage, I noted that it was still loud in the booths even though no painting was going on. The ETS Block Leader showed me the source of the sound was the Camera Air on the Fuel Lid Robots (used to protect lens during paint spray). During our conversation it was noted that it was a colossal waste of Electricity to always have Camera Air turned ON. I decided to take the task of conditioning the Camera Air more efficiently as a Kaizen and I asked another member of ETS who is an EDP to research the project with me as they are specialized in Paint Department and I am relatively unfamiliar to the people in that location.

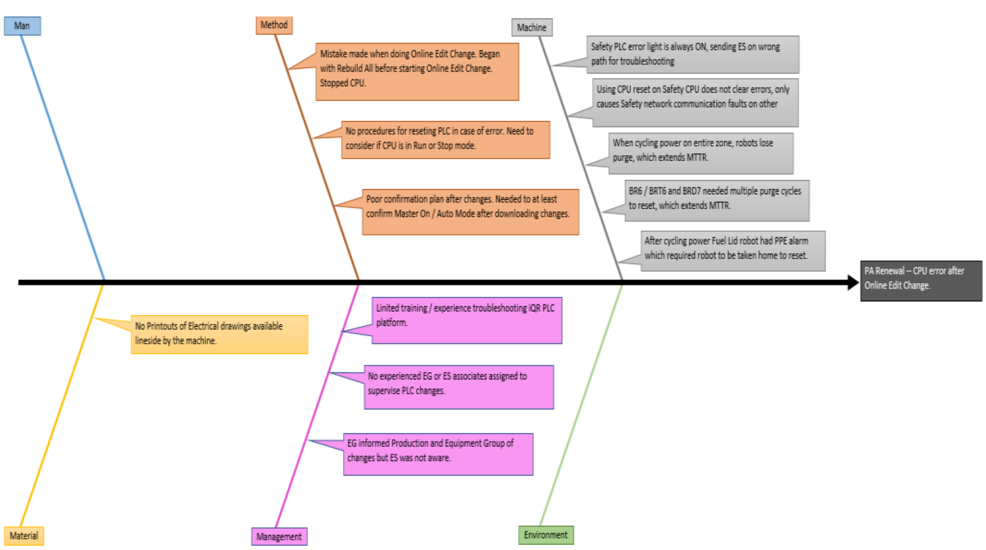
When I started my research I found the Camera Air was conditioned to turn on whenever the Paint Sludge underneath is flowing. According to the original Electrical Designer this was because the Sludge should only be running during Painting plus a little bit of extra time to allow the paint to settle, but in fact the sludge is always running and his assumption was incorrect. Thus we conditioned the Camera Air to turn OFF only when all of the Painter Robots in BC2 have been off for 3 or more minutes. The 3 minutes were added to ensure that paint was no longer aerosolized in the air near the camera.



The PLC program modifications shown above are to be copied and pasted into all four BC2 PLCs to save Camera Air on Fuel Lid Robots

The EDP and I worked together to research the most efficient way of communicating between PLCs in this environment. This was quite the hassle because the Control Network in this scenario was set up using a new network scheme that used tags made available by R-Series PLCs from Mitsubishi instead of typical bits. Having figured out how to use the Control Network to communicate between all of the PLCs at BC2 Stage we proceeded to create a program which could be applied to all four PLCs in BC2. It was important to make sure that the program inserted into each PLC was identical as this is the format in which Paint Renewal is programmed in (all PLCs at any stage must have identical program).

The PLC modifications we would have made communicated between all PLCs in BC2 using the Control Network in PA1 to confirm a series of conditions where it would be appropriate to turn off Camera Air for two Fuel Lid Robots. When the correct conditions would be met between the four PLCs at the BC2 Stage a signal was sent to both of the Fuel Lid Robots to turn OFF a vacuum pump, thereby saving Honda 31000$/year in unnecessary electricity wasted.



Fish Bone Analysis of Downtime in PA1

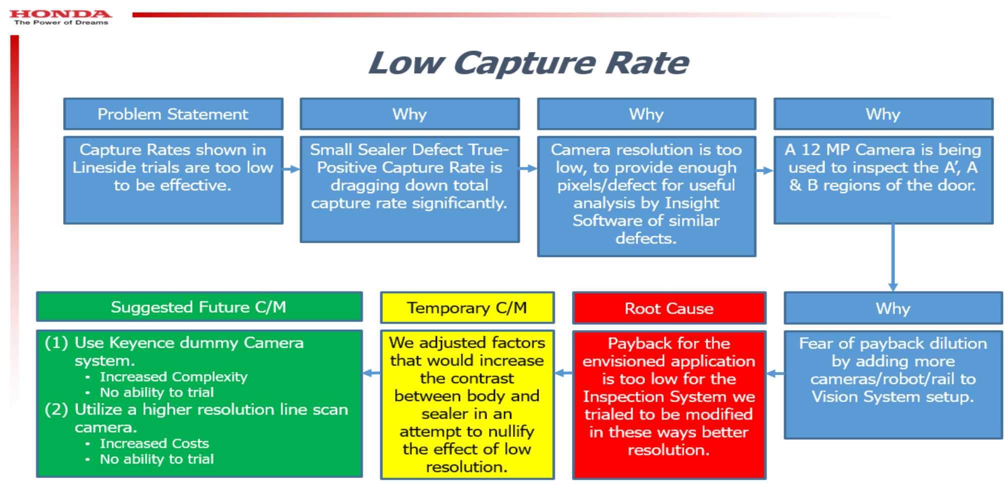
Unfortunately, when I wrote to the PLC I began with Rebuild All before starting Online Edit Change and created a fault which Maintenance tried to fix by cycling power to the i-QR series Mitsubishi PLC and SPLC (same rack) at the same time but that doesn't clear errors, it only causes Safety Network Communication Errors. The end result was downtime while trying to fix all the abnormals that came with cycling power on the SPLC. After this incident we did an analysis to identify why the downtime happened and put together a 1-page explanation to prevent it from ever happening again. I learned my lesson regarding safe editing procedure for mass-pro equipment and I took far more care from this point onwards when editing PLC/HMI programs to mass pro equipment.

3.2 PA1 Sealer Detection Feasibility Study: Monozukuri – Camera Programming, Manufacturing, Leadership & E-Flow

My Monozukuri team looked to reduce Sealer Defects in PA1. There were a variety of sources of Sealer defects and thus instead of trying to address the root causes of the Sealer Defect we decided to research a catch-all solution. This lead us to propose a Vision System which would complete a Defect Detection Inspection job.

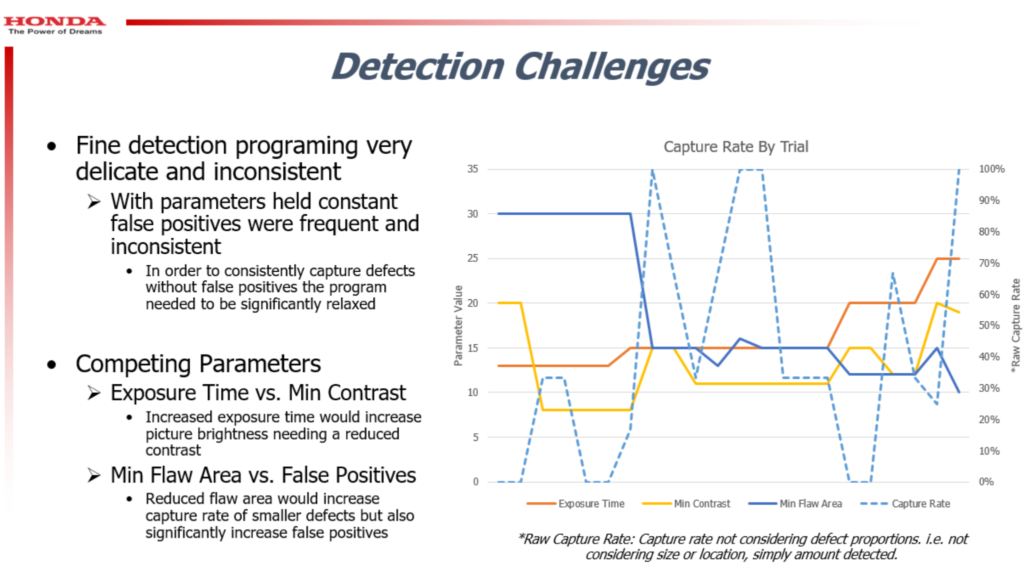
Typically, Monozukuri is only open to EDPs but during the 96Ki they opened it up to Interns as well and I leapt at the opportunity. I worked with a team of seven to follow the E-Flow Process, the goal being to determine a way to cost neutrally save money by reducing Excess Sealer Defects. Even though I was an Intern and not an EDP I took an informal leadership role in the group through my strong understanding of Cognex Programming, as the informal sole Technical Expert. I modified a power source and cable connector in the EGA-C shop to power up the Camera for the Static/ Lineside Trials. Additionally, as the informal sole Technical Expert in my group I swayed group decisions through my relatively deep understanding of the Vision System and was present at every trial to lead Camera programming and modification.

We struggled to increase our Lineside Trials Sealer Defect Capture Rate (31.33% global capture rate). The underlying problem for the feasibility of this idea was the cost of improving our resolution per defect was too high. If we focused on the whole panel with a single camera the resolution was too low and if we brought in multiple cameras to focus on a smaller area, increased the quality of the cameras, added a rail or robot our payback would shoot up too significantly to justify this project.



Why-Why Analysis of Low Capture Rate, producing both temporary and permanent countermeasures

We attempted to deal with the poor resolution by adjusting variables such as Exposure Time, Min Contrast and Min Flaw Area. This was done to allow the Defects on the Panel to stand out more prominently and have a better chance of being detected by the Vision System. However, as we tuned these values to extreme levels we found our Capture Rates became more volatile, thus rendering the Vision System unreliable. The Technology to Cost ratio has been improving rapidly in the field of Vision Systems for years, our team expects this trend to continue. However, at this time the Technology is too weak to justify this at the Cost for which it is available. We trialed roughly 900 CBUs but at the E-0 Stage we realized the Trial results were not strong enough to pay for the initial investment within 2 years, thus removing it from consideration as a potential improvement that PA1 might consider.



Volatility of Capture Rates contrasted with Exposure Time, Min Contrast & Min Flaw Area

Though this Feasibility Study did not result in a Green Light, I learned a lot by following the E-Flow process and gained valuable Vision Systems Development Experience with a focus in Inspection. Additionally, taking on a leadership role in a relatively large group at a younger age than my team members was also a great learning experience. This taught me many valuable lessons with regards to understanding team dynamics and influencing decisions in a positive and beneficial manner through a more technical lens as opposed to one of Project Management.

Section 3 Summary

I participated in Kaizens, Monozukuri & Skills Exchange as a part of my attempts to reach out and take on more of a Leadership role within HCM. These projects provided me with many Leadership opportunities whether they were in a group or partnership as I was working with peers who were not far beyond my level of Expertise. During these experiences I would use my relatively strong Technical Experience to provide some sense of Leadership and Direction for many of these projects. For example, during the Skills Exchange I took on a vast majority of the Design Work and even supported the Project Management aspects of the project due to my *relatively* in-depth knowledge of what needed to be done. All of the tasks highlighted in section 3 provided me not only with immense Technical Experience but with Leadership Experience as well.

Section 4 Table

Skills Inventory	Skill Level
Manufacturing/Hands on Skills with Tools	Expert - Teaching others about the skill
Project Management	Intermediate - May need occasional guidance/review of work
E-Flow	Intermediate - May need occasional guidance/review of work
PLC Programming	Advanced - Needs no guidance for most tasks
Electrical Hardware Design	Expert - Teaching others about the skill
Electrical Spec Creation	Expert - Teaching others about the skill
Fanuc Robotics Programming	Intermediate - May need occasional guidance/review of work
HCM style Presentation	Intermediate - May need occasional guidance/review of work
Vision Software Design	Intermediate - May need occasional guidance/review of work
HMI Design/Programming	Expert - Teaching others about the skill
Mentoring	Intermediate - May need occasional guidance/review of work
Customer Relationship building	Expert - Teaching others about the skill

Section 5 Table

Project	**Responsibility**	**Challenges**	**Output**
XW - New Model Rear Inner HMI Design & Commissioning Support	Designed HMI and modified PLC (Cycle Time program, Energy Conservation program), support Commissioning Checks.	- 13 hour work days for a whole week can bring a degree of fatigue	Weld 2 New Model Item*
XW - New Model FSR & GW Electrical Design	Electrical Hardware Design & Software (PLC/HMI) Design for FSR & GW line in Weld 2. Mentoring/Guiding new Intern who is going to take over this task.	- Project Scope changed after Design already began, scheduling more hectic.	Weld 2 New Model Item*
ST - Autopiling Commissioning Support	Supported Commissioning; HMI mods, PLC mods (Cycle Time program, Vacuum Pumps)		ST New Model Item*
XW - FSR End of Life Robot Replacement Electrical Design & Spec	Completed Spec, Electrical Hardware Design, Software (PLC/HMI) Design for Robot Replacement in FSR Weld 2. Upgrading from Motoman XRC to Fanuc.	-Old line with many differences from Electrical Drawings -Large scale, hundreds of changes in Hardware and Software to Mass-Pro Equipment.	Weld 2 Quality Item*
XW - Water Leak Improvement Electrical Design & Spec	Completed Electrical Spec outlining scope & Electrical Hardware Design.	- Project was stalled multiple times but Install dates weren't moved back, thus Design time was squeezed to accommodate for parts lead time.	Weld 2 Quality Item*

XW - Dedicated Mig Station Electrical Spec	Completed Electrical Spec outlining scope of Electrical Design and familiarizing with line.	-familiarizing myself with old Mig System installations (documentation took a while to understand).	Weld 2 Quality Item*
PO - IMM2 Robot HMI Design Lead & Commissioning Support	Designed and Implemented HMI at IMM2 in PO4, supported Commissioning.	- Customer kept changing preferences after seeing end-result in real life. I made many changes after the Install.	PO Quality Item*
PA - Renewal Fuel Lid Robots Camera Air Savings (Kaizen)	Researched and Designed solution to Camera Air waste that would reduce waste, not implemented yet.	-learning and understanding Control Network "Tagging" system took some time, no other example seen in Honda.	Energy Savings: 30000$/year
MC - MOD 3 CNC No Body Reamer Disable Modification(ETS)	Researched, Designed and Implemented a CNC Reamer disable function, my portion of the project focused on the PLC my partner focused on the CNC. This is a temporary counter measure to prevent frequent Reamer damage.	- Old & convoluted design made investigation more difficult - No prior experience with CNC's or Transfer PLC's	Reamer Cost Savings:16813$/Ki
EGAC - Testing Platform Business Plan Item	Managed Project, Researched, Designed & Manufactured a series of Testing Platforms	- Schedule management - Lots of learning during manufacturing stage meant many retroactive changes to old designs.	Reduce workload hours: 14960$/Ki
MC - Ethernet Fault Research and Recommendation (ETS)	Researched Managed Ethernet Switch configuration for cable diagnostics and created a manual on the topic, recommendation was added to Equipment Construction Spec in MC Engine Plant.	- First switch needed to be factory reset after some extremely arduous troubleshooting showed that someone had been tinkering with some Configuration settings.	Downtime Prevention: 11340$/incident
MC - Guide Feeder Abnormal Research and Solution Design (ETS)	Mentoring/Guiding new Intern who is Researching and Implementing a solution to occasional double stacking on a Guide Feeder in MC Engine Plant.	- Time constraint due to heavy overall workload and non-critical OT reduced to 0 hours/week - HDR describing Downtime is very vague, research may be difficult	Downtime Prevention: 8453$/incident
XP - Sealer Line 3D iR Vision Systems Upgrades Design	Researched and Designed solution to source of Downtime on Sealer Line 3D iR Vision System.	- had to be very resourceful to learn the basics of 3D iR Vision System programming, very few human resources in the plant.	Downtime Prevention: 7468$/incident
XW - Hoodline Energy Conservation PLC program addition	Researched & Implemented Energy Conservation program to Hoodline Weld 2 PLC.	- New to Honda, still learning PLC basics.	Energy Savings*
TP - Sealer Defect Detection E-Flow (Monozukuri)	Conducted Feasibility Study for the implementation of a Vision System to capture Sealer defects. I was in charge of programming, manufacturing and lineside trial design.	-First E-Flow experience, big learning curve -Only member of team familiar with Cognex	Concluded E-Flow with a no-go recommendation.*
EGAC - Skills Exchange 96Ki Electrical Design	Designed a fun and interactive game for associates to play. Programmed Robot & Vision System to work together for Vision-Guidance (resetting cell) and Inspection (grading).	- very little time to Design all changes to Systems created a stressful (but fun) build process.	The Joy of Creating & Having Fun!*

Unquantified *