Darryl Stahlke

Experience Record

File Number: 100148730

Post Graduation Experience	
Start Date	January 1, 2009
End Date	June 1, 2010
Company	**AECOM, Hamilton, Ontario**
Department	Instrumentation and Automation
Position	Instrumentation and Automation Designer
Supervisor	**William Dohmen**
Client	**Regional Municipality of Peel (Greater Toronto Area)**
Product	**Water Booster Pumping Station**
Responsibilities	
	Implement the process control narrative (PCN) into functional code for the Battleford Road Water Booster Pumping Station. Entire development and installation of PLC and HMI control systems.
2.2.1 Application of Theory	
Analysis	The PCN and the site design specifications (SDS) were reviewed for quality assurance purposes between documents. Review the contractors hardware choices based off the SDS and ensure they fulfill the design requirements.
Design and Synthesis	The project requires interpretation of the PCN provided by the senior project lead to implement into programmable logic. Any resulting changes are documented in the PCN and approved with the process engineer.
Testing Methods	I created a comprehensive list of all system inputs/outputs in order to do extensive testing. An industry standard software Factory Acceptance Test (FAT) plan was created to demonstrate proper system functionality to the Region of Peel (RoP). The test plan evaluates the exact operation of all instruments and equipment within the process. Testing is done first as an internal audit of proper functionality and again with Region representatives for approval and signoff.
Implementation Methods	I inspected the electrical panels prior to site install to verify they met industry and RoP standards. Quality assurance was conducted on all electrical points within the panel in accordance with the respective electrical drawings.
2.2.2 Practical Experience	
Function of components as part of the larger system.	The SCADA system within the Battleford pumping station is a complete and independent system with its own reporting and logging. I was also responsible for integrating the Battleford SCADA into the Region-wide SCADA system. To integrate into the Region-wide system, the system was locked against edits throughout the Region. This time critical lockout was scheduled with several Region representatives.
Limitations of practical engineering and related human systems in achieving desired goals.	During commissioning of the plant I experienced the Theory vs. Practical limitation. The system had four pumps to control the water pressure boost, and while in theory the process design team had made good decisions on how to determine how many pumps to run and how to start/stop them, the practical system exposed many limitations of their design.
The significance of time in the engineering process.	There were many project milestones to this project. If any of these milestones were not met on time the general contractor would claim it delayed the overall process. Any delays to the project would have allowed the general contractor to submit added expenses above and beyond the site contract.
Knowledge and understanding of codes, standards, regulations and laws that govern applicable engineering activities.	Safety standards for construction sites were reviewed and enforced for general construction sites and confined spaces. I became familiar with Ministry of the Environment (MOE) standards and contracts. I also became familiar with the Electrical Safety Authority (ESA); having the site electrical panels inspected to ensure public electrical safety.
2.2.3 Management of Engineering	
Planning	The PCN had to be updated to reflect required PLC tags to accomplish the project. This planning was done prior to any code development and submitted to the region for approval.
Scheduling	As the lead PLC and HMI programmer it is my responsibility to schedule the development and to maintain appropriate lead times for all stages of development and installation. The schedule is constantly fluctuating based on site construction progress.
Budgeting	Working within the allocated time allotment for each aspect of the development requires a focused and structured plan to stay within the project budget. It is my responsibility to stay on schedule within the hours allocated to ensure the budget is not exceeded.
Supervision	While on site I am in charge of ensuring AECOM representatives adhere to the site safety plan. Minimum requirements for construction sites are safety boots, hard hat and safety glasses. It is also my responsibility that no one enters into unnecessary dangerous situations; for example confined spaces.
Project Control	I scheduled meetings between the client, contractors, and AECOM for the purpose of testing and quality assurance. Multiple meetings are scheduled; electrical panel FAT, PLC FAT, and HMI FAT.
Risk Assessment	The process lead and I discussed multiple scenarios for the automatic control of the booster pumps and the associated impacts. The best situation where the least energy is consumed to achieve similar boosting response was the main focus.
2.2.4 Communication Skills	
Preparing Written Work	It was my duty to complete the PCN for the automatic control logic of the pumping station. In this, I describe the functionality of the automatic sequencing in simple terms that are understood by anyone familiar with the process and not necessarily with its programming. I also created SCADA operator training manuals for use during training sessions with field staff.
Making oral reports or presentations	I led the Factory Acceptance Test for a team of AECOM Process Engineers, Region representatives, and OCWA (Ontario Clean Water Agency) representatives. The test was an all day simulation of the system and seminar on how the system will work.
Making presentations to the general public	N/A
2.2.5 Social Implications of Engineering	
The value or benefits of engineering works to the public.	The Battleford Road Pumping Station takes water from Zone 3 and pumps it into Zone 4A. Zone 4A has been limited with poor water pressure for several years. The residential area continued to grow but the water service remained the same. Now the public that live within Zone 4A have consistent water pressure to their property.
The safeguards in place to protect the employees and the public and mitigate adverse impacts.	On site there were several safety issues. It was my responsibility to ensure that the safety plan was followed by myself and colleagues. At a minimum the construction site required safety boots, safety glasses and a hard hat.
The relationship between engineering activity and the public at large	During project commissioning, the public had to be notified of the startup as there was a potential for dirty water to be present within Zone 4A because the system was reversing the water direction through existing water mains (which would clean the pipes). The public was informed through a public notice flyer and newspaper advertisement.
The significant role of regulatory agencies on the practice of engineering	Ontario Clean Water Agency was on site monitoring startup at all times. The OCWA representatives were responsible for ensuring the water within the system was safe to distribute prior to going online. Chlorine levels were checked at multiple points throughout the station and water was pumped onto a splash pad until the level reached an acceptable level. Their support is necessary to ensure that the safety of the public is always taken into account.

Post Graduation Experience	
Start Date	October 1, 2008
End Date	March 1, 2009
Company	**AECOM, Hamilton, Ontario**
Department	Instrumentation and Automation
Position	Instrumentation and Automation Designer
Supervisor	**William Dohmen**
Client	**Essar Steel (Sault Ste. Marie, Ontario)**
Product	**Casthouse Filtration System**
Responsibilities	
	Develop and implement the Human Machine Interface (HMI) for Blast Furnace No. 7 Baghouse at Essar Steel in Sault Ste. Marie, Ontario.
2.2.1 Application of Theory	
Analysis	Reviewed and analyzed the clients SCADA requests; added to the scope additional information that would be beneficial to determining optimal filter cleaning cycles.
Design and Synthesis	The clients specifications were reviewed to ensure the final product was compliant with their standards. The client reviewed the product during its design stage and offered comments and additional changes to improve the product.
Testing Methods	Complete testing of the HMI was done to verify all I/O points in conjunction with the project CAD drawings.
Implementation Methods	Testing was conducted off-site in Hamilton to ensure that no errors existed within the program. As this system was to be installed in a running facility, it was important that any issues were resolved prior to commissioning.
2.2.2 Practical Experience	
Function of components as part of the larger system.	During the start-up of the casthouse exhaust system, the effect of its reliability and accuracy was observed and how it impacts the safe work environment for the entire blast furnace and all workers in the area.
Limitations of practical engineering and related human systems in achieving desired goals.	Despite what the manufacturers specifications described, real-world operation of the valving within the exhaust system limited the operation of the exhaust system from the expected design plan. On-site design changes were made to eliminate the error.
The significance of time in the engineering process.	The blast furnace baghouse had a strict timeline as per Ministry of the Environment (MOE) requirements. Any delay in startup resulted in hefty fines to the client. As a result, scheduling of design and installation was key to satisfying the customer and the MOE.
Knowledge and understanding of codes, standards, regulations and laws that govern applicable engineering activities.	I became familiar with Ministry of the Environment (MOE) standards on the emissions allowed into the atmosphere and the fines associated with not complying to such regulations.
2.2.3 Management of Engineering	
Planning	Planning of the HMI screens was done by examining the I/O points to determine what devices were required on the screens.
Scheduling	The number of screens to be developed was determined through planning and then milestones were scheduled in order to achieve the timeline set forth by the client.
Budgeting	As additional requests were made by the client, it was my responsibility to propose a time/cost analysis for senior project management.
Supervision	On site training was done with each operator. It was my responsibility not only to train the operators, but to supervise their first shift with the new system to ensure that all extra questions and issues were resolved in a timely manner.
Project Control	N/A
Risk Assessment	N/A
2.2.4 Communication Skills	
Preparing Written Work	Detailed operators and maintenance manuals were created to train new employees and to assist in troubleshooting future issues with the system that might occur.
Making oral reports or presentations	All employees that worked within the casthouse were trained how the baghouse functions, how to control it and how to resolve minor issues that may arise during day-to-day operations.
Making presentations to the general public	N/A
2.2.5 Social Implications of Engineering	
The value or benefits of engineering works to the public.	The startup of the baghouse began a new era for the Sault Ste. Marie community. The baghouse was designed to take the particulate out of the exhaust emissions from the steel plant's Blast Furnace No. 7 Casthouse. Until the filters were installed you could easily see the iron dust entering the atmosphere with the naked eye (orange cloud). After the baghouse filtration system was installed only steam was visibly emitted into the atmosphere.
The safeguards in place to protect the employees and the public and mitigate adverse impacts.	Within the application; while critical alarms were present they are continuously displayed every 5 minutes. I came up with this idea to ensure that a change in operators or a shift change will not result in critical system information being lost. Making a best effort to remove potential dangerous situations to both employees and the public as a result of operator intervention. Also, all employees had to use the appropriate personal protective equipment in line with site specific health and safety plan.
The relationship between engineering activity and the public at large	N/A
The significant role of regulatory agencies on the practice of engineering	The baghouse engineering drawings date back to 1970 and some duct work was installed in the 1980s before the project was put on hold. It was only because of significant role the Ministry of the Environment played in pressuring the project that it was finally completed.

Post Graduation Experience	
Start Date	June 1, 2007
End Date	September 30, 2008
Company	**Micro Consulting Inc., Mississauga, Ontario**
Department	Industrial Electronics
Position	Electronics Designer
Supervisor	**Ignatius Michael Gomes, P.Eng. File Number: 16525016**
Client	**Cutler-Hammer Eaton Electrical (Calgary, Alberta)**
Product	**Electric Firepump Controller**
Responsibilities	
	Develop embedded firmware for the LMR PLUS Fire Pump Controller. Make updates to the electronic circuit boards as internal testing exposes issues with the system prototypes.
2.2.1 Application of Theory	
Analysis	The firmware specifications were submitted in flow charts. During initial project design, the flow charts were reviewed for quality assurance purposes. Any issues that arose were conveyed to the client for review. Both the client and I attended the system review by FM Global who examine loss prevention products and services to certify they meet rigorous loss prevention standards.
Design and Synthesis	After the first prototype fabrication, I took over all design of the electrical circuit boards. This included adding and substituting parts in the board layout, placing the new parts in the design and routing the electrical circuits to spacing and safety codes. It also included updating the product bill of materials for the purchasing department. The firmware included HTTP protocol, Modbus communications and USB data transfers which were all new components that I had to research their electronic design, design the electric circuits, and create the custom firmware. The firmware included complicated routines such as true RMS voltage and current measurements.
Testing Methods	A full test setup with a watermain, fire pump and pressure transmitters was not feasible during the initial prototype stage. Thus I designed and constructed a wiring harness to simulate all I/O to the system using switches, resistors, potentiometers and voltage sources.
Implementation Methods	My role on the project included sourcing the electrical components and finding the most economical suppliers and vendors. As such, for each alternate part found, the datasheet had to be examined to ensure that it was in fact an equivalent in all necessary aspects for the design.
2.2.2 Practical Experience	
Function of components as part of the larger system.	The firepump controller underwent extensive EMI testing to ensure the reliability of onboard microcontrollers, and that proper operation would not be critically affected by larger than expected electrical disturbances from external transfer switches and contactors in the field.
Limitations of practical engineering and related human systems in achieving desired goals.	This project was one of the first within our production facility to be compliant with Restriction of Hazardous Substances (RoHS) standards. The new lead-free solder created many issues in proper soldering as the temperature profiles for the solder reflow machines had to be evaluated. Lead-free solder looks dull all the time which added difficulty to the production employees ability to detect an incorrectly soldered component.
The significance of time in the engineering process.	The firepump controller has many outputs that are driven by relays. Research was done into how may pump starts before the relays needed to be replaced to ensure acceptable relay contact connection and ensure the contacts would not fuse on pump startup.
Knowledge and understanding of codes, standards, regulations and laws that govern applicable engineering activities.	The circuit boards and enclosures I designed followed all industry standards where the product was to be sold. IEC and CSA standards were followed. Double insulation spacing was used on all A/C input / transformer connections to ensure added safety within the product.
2.2.3 Management of Engineering	
Planning	As the lead firmware designer and hardware designer it was within my scope to plan out the entire project and to delegate responsibilities to other colleagues. I spent many hours detailing the hardware configuration and firmware logic in order to make sure that all product requirements were specified and listed in an itemized list.
Scheduling	As lead designer, I had to maintain project direction and ensure all prototypes were shipped on schedule. It was my responsibility to time-schedule and manage two other firmware and electrical designers throughout the project.
Budgeting	As the lead designer, it was my responsibility to create time-cost estimates for both software and hardware change orders. It was also within my scope to ensure colleagues work within and maintain the outlined budget.
Supervision	As the head of the Engineering department, I supervised the productivity and quality of work of two other designers. In doing so, it was also my responsibility to assist with any problems that arose in their product development. This was done through research and additional testing.
Project Control	Internal weekly meetings were scheduled to discuss progress and technical issues related to the project. In these meetings progress was tracked and additional resources given to maintain the project schedule. Weekly meetings were also held with the client to communicate project progress and intended progress moving forward.
Risk Assessment	N/A
2.2.4 Communication Skills	
Preparing Written Work	I created a detailed product manual describing its features and operating instructions. For example, a detailed schematic of how to connect the serial lines for both RS-485 and RS-422 configurations was created for Modbus documentation. Manuals and reports were also created for the fixes to common repairs required for the employees repairing Return Merchandise Authorization (RMA) units within the manufacturing facility.
Making oral reports or presentations	Weekly telephone conferences were held with the client to ensure that all issues were resolved promptly so that the project could move forward in a timely fashion. It was my duty to attend these weekly calls and discuss any firmware issues with the client.
Making presentations to the general public	N/A
2.2.5 Social Implications of Engineering	
The value or benefits of engineering works to the public.	The firepump controller is installed in apartment buildings, etc. where city water pressure does not meet the building demands during a fire emergency. As a result, the proper operation of the controller is vastly important to public safety. Injury or loss of life is a possibility if the specified functionality of the controller is not met.
The safeguards in place to protect the employees and the public and mitigate adverse impacts.	All testing harnesses were designed with safety in mind. An insulated cover, that covered all connectors and open electrical contacts, had to be installed prior to power being connected to the circuit under test. This ensured total safety while the connectors are installed by employees. Plastic screwdrivers were used during testing to adjust calibration potentiometers on the circuit, electrically isolating the employee from the circuit.
The relationship between engineering activity and the public at large	N/A
The significant role of regulatory agencies on the practice of engineering	FM Global was present during full testing of the controller to ensure the controller hardware and firmware met all necessary loss prevention standards.

Post Graduation Experience	
Start Date	July 1, 2006
End Date	October 30, 2007
Company	**Micro Consulting Inc., Mississauga, Ontario**
Department	Industrial Electronics
Position	Electronics Designer
Supervisor	**Ignatius Michael Gomes, P.Eng. File Number: 16525016**
Client	**Cutler-Hammer Eaton Electrical (Burlington, Ontario)**
Product	**Industrial Battery Charger**
Responsibilities	
	To develop the battery charger firmware and perform all testing. To create easily expandable firmware logic that could be adapted to charge any type of battery. Make necessary circuit board updates and associated manufacturing procedure changes.
2.2.1 Application of Theory	
Analysis	Extensive research was done in the area of how batteries are charged (Lead-acid, NiMH, Li-ion and NiCd). Specific attention was placed on the proper charging algorithm of Lead-acid automotive batteries.
Design and Synthesis	A state machine was designed that would allow the firmware to select between three different battery types on startup. The logic of the firmware relied on a lookup table for alarms, switching charging modes, power output, and regulating conditions. The entire structure was designed prior to implementation in order to streamline the code and reduce rework.
Testing Methods	The battery charger was tested using standard jumper cables and a standard automobile battery in the early stages. Further into the project, when firmware functionality was verified, it was necessary to setup the charger to deliver power into a ceramic power resistor so that its full output power and reliability could be examined.
Implementation Methods	The battery charger was tested for continuous operation to determine the temperature of the system. Key electrical components were setup with data loggers to track their temperature to ensure product reliability.
2.2.2 Practical Experience	
Function of components as part of the larger system.	The battery charger was designed to be an optional product with Diesel/Diesel Plus Firepump controllers. Diesel firepump controllers use a diesel engine to power the water pump. The battery charger was designed to have all required alarms and meet industrial power requirements with load sharing capabilities for redundant operation.
Limitations of practical engineering and related human systems in achieving desired goals.	The product was introduced well into the Diesel Firepump product lifespan resulting in a large and immediate demand. I had to manage substitute parts in order to avoid long purchasing lead times which would have resulted in product delays.
The significance of time in the engineering process.	After the design was approved by the client, the product was fast-tracked to production to replace an older model. It was my responsibility to schedule project landmarks and ensure that they were met. This included firmware, circuit design and purchasing milestones.
Knowledge and understanding of codes, standards, regulations and laws that govern applicable engineering activities.	The circuit board was designed to meet IEC electrical spacing standards and components were chosen in order to achieve UL certification. The chargers enclosure was designed so that the entire product achieved CSA approval.
2.2.3 Management of Engineering	
Planning	The basic structure of the lookup table was developed; with detail in its required data to allow any type of charging algorithm. I planned the entire low level structure using flow charts as the project's first step to reduce development time and to catch missing features at an early point in the project.
Scheduling	As the lead firmware developer from the inception of the project it was my responsibility to detail a timeline on when significant milestones could be achieved. It was then my responsibility to stick closely to those deadlines and make sure the project moved forward on schedule.
Budgeting	The battery charger went through many revisions to support numerous battery types. I would submit estimates on the time required to research and implement the necessary features to my manager. I was responsible to have the product's metal enclosure quoted by several fabrication houses and negotiate tooling charges contingent on finalizing a contract.
Supervision	The majority of the circuit board changes were done by a junior engineer under my supervision. Not only did I manage his time on the project but I had to review all changes to ensure its correctness before sending the CAD files out to a manufacturing house.
Project Control	After the departure of the electrical designer on the project, the entire project scope relied upon me. As such I had to coordinate my time and the junior engineer's time between electrical design and firmware development to achieve the product launch target. As the manufacturing quality control supervisor I also had to ensure that the testing procedures were extensive and make appropriate changes that arose throughout production.
Risk Assessment	N/A
2.2.4 Communication Skills	
Preparing Written Work	I created an operations manual for the client that detailed how each mode would charge a battery. It included the setup options through it's DIP switches, explained short-forms that may appear on the LCD, how to properly wire the terminals (charging, sensing and temperature wires). I also created programming manuals that described the algorithms used to charge batteries (as found during product research), documented the firmware logic and included process flowcharts.
Making oral reports or presentations	Several meetings were held with client representatives to ensure all demands of the project were identified in the early development stages: discussing size requirements, power requirements, temperature requirements and deliverability.
Making presentations to the general public	N/A
2.2.5 Social Implications of Engineering	
The value or benefits of engineering works to the public.	N/A
The safeguards in place to protect the employees and the public and mitigate adverse impacts.	I developed a test setup to test each circuit board after each major production stage. A test system was made for the charger as a simple built circuit board as well as when it was fully functional within its enclosure. Both test systems were designed with the employees safety in mind. The charger was enclosed within a plastic case that had to be closed for power to be applied. This guaranteed that no shortcuts were taken by the testing employee that would jeopardize their safety.
The relationship between engineering activity and the public at large	N/A
The significant role of regulatory agencies on the practice of engineering	During UL evaluation the representative noted that the internal fuse in the product should have a ceramic fuse rather than a glass fuse. This significant request would eliminate the potential of the fuse blowing, glass breaking, exploding through the vents of the enclosure and potentially causing injury.

Post Graduation Experience	
Start Date	January 1, 2006
End Date	December 31, 2006
Company	**Micro Consulting Inc., Mississauga, Ontario**
Department	Industrial Electronics
Position	Electronics Designer
Supervisor	**Ignatius Michael Gomes, P.Eng. File Number: 16525016**
Client	**Cutler-Hammer Eaton Electrical (Lachine, Quebec)**
Product	**160/55W 24V DC Power Supply - 600VAC Input**
Responsibilities	
	To create firmware to monitor the power output, phase voltages, output voltage, current and ripple in a industrial power supply. To make circuit board layout changes as required throughout the development stages of the 55W and 160W power supplies.
2.2.1 Application of Theory	
Analysis	Throughout the project, many hours of testing went into achieving a stable power supply. Product reliability was tested extensively in finding the final solution. Temperature concerns and stability of the control loop were the major factors driving the extended testing.
Design and Synthesis	The power supply was based off an existing product. The product functionality was pre-determined by the client based off the existing product. I expanded upon the existing product by introducing new features within the firmware. One feature was monitoring the power output duty cycle, period and cycle count to safeguard the electronics from overheating due to an out of specification load demand. Another was to improve the phase loss detection algorithm to detect phase loss with no load attached.
Testing Methods	I designed the first stage tester to operate the power supply under lower input voltages (230V AC) to allow most manufacturing errors to be corrected without full power being applied. The final stage tester would apply 600V AC to the power supply. Proper functionality was verified by applying an oscilloscope to the several test points throughout the operating circuit and to its power output terminals. The waveforms on these points were described in the production manuals to ensure proper operation, voltage and ripple levels.
Implementation Methods	I was responsible for the testing standards and quality of the manufactured product. I created testing procedures that would ensure the quality of the product, testing the hardware functionality of each module within the system. All Return Merchandise Authorization (RMA) went through me to ensure that all possible hardware issues were corrected in the design. It was also my responsibility to produce general RMA repair manuals to troubleshoot common issues.
2.2.2 Practical Experience	
Function of components as part of the larger system.	It was observed that the tolerance and lot of components played a major role in the reliability and stability of the power supply. Additional development time was assigned to the project to resolve these issues and should be taken into account when planning a project.
Limitations of practical engineering and related human systems in achieving desired goals.	Developing the phase loss detection algorithm was difficult because of varying component tolerances. Different output curves would be seen using an oscilloscope for two different power supplies, built on the same lot of components. The algorithm was developed to detect a minor typical issue experienced on all units despite its component lot.
The significance of time in the engineering process.	Power supplies that were overloaded for extended periods of time would return failed because of heating issues. Corrective actions were taken to attach component heat sinks to the enclosure in order to distribute heat more effectively.
Knowledge and understanding of codes, standards, regulations and laws that govern applicable engineering activities.	The circuit board was designed to meet IEC electrical spacing standards and components were chosen in order to achieve UL certification. The power supply enclosure was designed so that the entire product achieved CSA approval.
2.2.3 Management of Engineering	
Planning	Prior to any logic development of the firmware, the output of the power supply was examined in relation to its power input levels. This allowed me to plan how features like low-line detection and ripple detection would have to work within the firmware.
Scheduling	I was given a completion date for the final release of the firmware. It was my responsibility to schedule my time and set appropriate milestones in order to achieve the given deadline.
Budgeting	I was responsible for finding suitable alternate parts for components with long lead times or end-of-life components that were increasing in price to ensure that the overall product remained within the original cost estimate.
Supervision	I supervised all RMA repairs and manufacturing testing within the facility. It was my responsibility to ensure employees were safe during product testing and to halt operations if I determined there was a reason for concern.
Project Control	At the completion of the 160W power supply, the same product was transformed to operate as a 55W power supply. Only the firmware differs between the two units. The overload and ripple detection algorithms had to be reworked as the output abnormities varied with the smaller load attached. At a manufacturing level, I created and updated test procedures to include tests that would find errors previously not found during testing.
Risk Assessment	N/A
2.2.4 Communication Skills	
Preparing Written Work	Manuals detailing the firmware were created. This included logic flow charts and detailed explanations of sample times and calculations used in determining output ripple. During prototype testing graphs were drawn showing the DC output ripple under low-line conditions. This documentation was key in the development of the ripple algorithm that would detect low-line input conditions. The documentation was also important to future employees taking over future product development.
Making oral reports or presentations	N/A
Making presentations to the general public	N/A
2.2.5 Social Implications of Engineering	
The value or benefits of engineering works to the public.	N/A
The safeguards in place to protect the employees and the public and mitigate adverse impacts.	The test system I designed had a door that would flip open and the power supply would slide in and be completely enclosed. When the door was open, all power to the test system was disconnected using relays. The design of the test setup made it impossible to be in contact with any potential associated with the power supply when power was applied, achieving a safe working environment for the production staff.
The relationship between engineering activity and the public at large	N/A
The significant role of regulatory agencies on the practice of engineering	The device was CSA and UL approved to ensure its safety. Operating off 600V AC safety must be top priority for the device as it is installed in open cabinets and there should not be any risk of touching its enclosure while in operation.

Post Graduation Experience	
Start Date	December 1, 2005
End Date	March 31, 2006
Company	**Micro Consulting Inc., Mississauga, Ontario**
Department	Industrial Electronics
Position	Electronics Designer
Supervisor	**Ignatius Michael Gomes, P.Eng. File Number: 16525016**
Client	**S & C Electric (Etobicoke, Ontario)**
Product	**Electrical Knife Switch Controller**
Responsibilities	
	Revise knife switch controller to use surface mount components rather than through-hole components. Determine cause of high rate product failures. Modify the firmware to guarantee operation switching times.
2.2.1 Application of Theory	
Analysis	The existing controller was examined to determine the cause of the failed units. In disassembling several units it was determined that each failed device had at least one failed optical switch. The optical switches were sent back to their manufacturer to determine their failure cause; it was recommended that intrinsically safe components would resolve the issues. It was found that the optical switches were being compromised by contaminants in the air while installed on location.
Design and Synthesis	I redesigned the circuit board from scratch in OrCAD to update the layout to a supported CAD format. It was my job to re-specify all through-hole components to a suitable surface mount component.
Testing Methods	Each component was tested on sample faulty boards by simulating inputs and outputs. An oscilloscope was used to capture the electrical response and determine that the optical switches were not functioning properly.
Implementation Methods	Intrinsically safe optical switches were only available in sealed cases which prevented them from being installed in the circuit board for correct product operation. I was given the task of finding an alternative solution and found that the optical switches could be vacuum injected with resin to fill the small voids that were compromising their reliability.
2.2.2 Practical Experience	
Function of components as part of the larger system.	The client had a firmware update request to ensure that an open-to-closed transition would complete within 6 seconds of initiation. In order to guarantee this operation, the firmware had to be modified to preload the spring mechanism within the knife switch.
Limitations of practical engineering and related human systems in achieving desired goals.	Each knife switch operates slightly different due to manufacturing of its worm gear and spring mechanism. In order to avoid any issues in preloading the spring mechanism too little or too much, the firmware was modified to learn its environment; to train itself during calibration.
The significance of time in the engineering process.	The optical switches were affected after a prolonged time in the field experiencing all weather conditions. The controllers were shipped as functioning units but the time in the field exposed to contaminants in the air caused the optics to fail.
Knowledge and understanding of codes, standards, regulations and laws that govern applicable engineering activities.	The circuit board was designed to meet IEC electrical standards. The firmware was written in standard assembly language code.
2.2.3 Management of Engineering	
Planning	The size, shape and hole locations of the circuit board were restricted in its original format. Pre-planning of component location and orientation was required. The orientation and location of surface mount parts can be critical. The layout was designed to keep surface mount resistors and capacitors parallel to circuit board score lines to prevent component cracking when separating panels into individual device circuit boards.
Scheduling	A flexible schedule was outlined for this project as there were so many external circumstances. Both the manufacturers investigation and the quotation to vacuum seal was mostly out of my control. I was in contact with representatives from both companies to maintain project progress.
Budgeting	The unit price of the device was a concern to the client. It was critically important that I find a company that would vacuum seal the components and charge by lot, not by unit to keep the final price of the installed optical switches within budget.
Supervision	I supervised the manufacturing, testing and repair production lines. It was my responsibility to ensure that all tests were performed accurately and in a timely manner.
Project Control	The project was broken into several sections. Determine the problem, send the components back for inspection by manufacturer and develop a solution to resolve the problem. Since the project was delayed by external resources, it was important to coordinate these phases, and keep on top of these external resources to keep the project moving forward.
Risk Assessment	N/A
2.2.4 Communication Skills	
Preparing Written Work	Reports of the optical switch findings were created and submitted to my manager and to the client for review. Manufacturing procedures had to be updated to coincide with the component changes (surface mount). All purchasing documents and bills of materials were updated to reflect the changes.
Making oral reports or presentations	A presentation of the cause of device failure was scheduled and delivered to client representatives to brief them on the situation and convey expected delay times.
Making presentations to the general public	N/A
2.2.5 Social Implications of Engineering	
The value or benefits of engineering works to the public.	The function of the knife switch was to move knife switches between power lines; move the contacts from a failed power source to a working power source. They are installed outside at power stations; open to all weather conditions, a reason for the optical switch failures. Their proper operation allows delivery of power utilities to the general public.
The safeguards in place to protect the employees and the public and mitigate adverse impacts.	Appropriate personal protective equipment was worn by all employees during manufacturing and testing and while on site within power stations.
The relationship between engineering activity and the public at large	N/A
The significant role of regulatory agencies on the practice of engineering	The knife switch controller was designed to IEC electrical specifications. Adhering to these regulations ensures that operators are safe from electrical shock injury.

Post Graduation Experience	
Start Date	August 1, 2005
End Date	December 30, 2005
Company	**Micro Consulting Inc., Mississauga, Ontario**
Department	Industrial Electronics
Position	Electronics Designer
Supervisor	**Ignatius Michael Gomes, P.Eng. File Number: 16525016**
Client	**Freepour Controls (Mississauga, Ontario)**
Product	**ScanChecker**
Responsibilities	
	Determine and resolve the cause for the slow serial transmission rate between the device firmware (microcontroller based) and the computer application. Modify the design to have more memory so that more bottle information can be maintained within its database.
2.2.1 Application of Theory	
Analysis	Using an oscilloscope the serial communications was examined at the byte level. It was noted that over a transmission period, 75% of the time the transmitter/receiver was idle. The device firmware was investigated as the probable limiting factor because of its internal clock cycle. It was found that updating the LCD screen with progress percentage and bottle name details was consuming the microcontroller's processing power and time. It was also noted that data was transmitted in character format rather than ASCII encoding.
Design and Synthesis	The firmware was developed by a former employee of the client. The first step in correcting the transmission speed issues was to document the code into process flow pseudo code and flow charts. After the firmware was documented to its current state it was easier to modify it to remove speed issues. I also changed the circuit board to use interrupt lines for each keypad button. This allowed the system to enter sleep mode after a set time and use minimal battery power until the processor was awakened by an interrupt line changing state. The onboard SRAM memory chip was upgraded from 32K to 128K which required additional address lines within the circuitry.
Testing Methods	The easiest method of determining the leading cause of slow transmissions was to remove functionality and then test and time a transmission. It was found that 90% of the idle time was a result of updating the LCD to display what bottle was being transferred, a progress bar and a overall progress fraction. CrossTalk, an older DOS application, was used to monitor the serail communication stream. The SRAM expansion was tested using an oscilloscope to ensure the address lines were being set properly. Temporary read and write test instruction code was developed to test the entire address range for reliability.
Implementation Methods	Reducing the firmware to only update the LCD with the fraction of bottles transmitted and changing the transmission type from real character to ASCII coding reduced a full database transmission time from 135seconds to 12seconds, achieving over 11times the transmission data throughput. Almost all idle time was removed and the transmission data was sent in fewer bytes because of ASCII encoding.
2.2.2 Practical Experience	
Function of components as part of the larger system.	The final product had minor hardware modifications throughout the design. No hardware changes were required to improve the data transmission throughput. It is important that each module is thought out to the same degree in order to produce the best possible product. It was apparent that the firmware was designed for operating on a computer, not a microcontroller, diminishing the value of the overall product.
Limitations of practical engineering and related human systems in achieving desired goals.	The limitations of the microcontroller's processing power was overlooked in the design of the original firmware. The design scope should always be compared with the functional limitations of the system to make sure that the system is not overstressed.
The significance of time in the engineering process.	Throughout the project I managed my time on this project as well as several other projects. It was crucial to prioritize my efforts to keep this project moving forward on schedule as well as maintaining progress on the other projects.
Knowledge and understanding of codes, standards, regulations and laws that govern applicable engineering activities.	I had to have a good working understanding of standard serial communications protocols: Start/Stop bits, Parity, and Baud Rate. For the transmission encoding sequence, it was also required to have knowledge and understanding of both the ASCII code chart and cyclic redundancy check standards.
2.2.3 Management of Engineering	
Planning	It was important to plan my approach to improving speed times by reducing microcontroller processing demands. As it was not code I designed, a lot of time went into planning out the code changes as if it was being designed from scratch. Flow charts and logic descriptions were created to better understand the existing firmware.
Scheduling	I was in charge of scheduling my time in research and development so that valuable information could be communicated to the client at each milestone. This was key in the project going forward and receiving additional funding.
Budgeting	The client wanted to speed up the transmission rate as much as possible, but had a limited budget. It was my responsibility to look into the largest issues first and report findings and time cost to the client. A limited number of hours was initially given to investigate the issues as the client had already worked on the issue internally and believed that the bottleneck was the PC visual basic code, not the in product microcontroller.
Supervision	I supervised junior engineers on all circuit board modifications to ensure the proper changes were made to industry and electrical standards. Their goal was to produce a prototype model with the control buttons connected to interrupt lines to ensure that the requested changes were made and done to the given specifications.
Project Control	The project was divided into sections to keep the expenses of improving the speed under control. I coordinated the sections (LCD, testing, encoding, testing) within the timeline and budget set forth by the client. The expenses on the project were constantly monitored as this was simply an update to improve customer experience with the product and, as a result, the client had set a limited budget for the project.
Risk Assessment	N/A
2.2.4 Communication Skills	
Preparing Written Work	Documentation was created to describe the original state of the product's firmware. Monthly reports were also created documenting the progress of the project with suggested direction. At project completion, a detailed document was produced so that the client's programmers could fully understand the issues found and corrective actions taken within the firmware.
Making oral reports or presentations	At the completion of the project a presentation was given to the client's programmers and sales representatives as to what changes were made and what affect it would have on future units. A question and answer session was held to answer any additional questions.
Making presentations to the general public	N/A
2.2.5 Social Implications of Engineering	
The value or benefits of engineering works to the public.	N/A
The safeguards in place to protect the employees and the public and mitigate adverse impacts.	Appropriate personal protective equipment was worn by all employees during manufacturing and testing. Acceptable overhead ventilation was provided to remove toxic fumes at all leaded soldering stations.
The relationship between engineering activity and the public at large	N/A
The significant role of regulatory agencies on the practice of engineering	N/A

Post Graduation Experience	
Start Date	March 1, 2005
End Date	November 30, 2005
Company	**Micro Consulting Inc., Mississauga, Ontario**
Department	Industrial Electronics
Position	Electronics Designer
Supervisor	**Ignatius Michael Gomes, P.Eng. File Number: 16525016**
Client	**Alutron Modules Inc. (Aurora, Ontario)**
Product	**VacuVision Vacuum Display and Motor Soft-Start**
Responsibilities	
	Develop a circuit that would allow an AC motor to startup slowly to avoid high inrush currents. Determine the current draw at various filter levels and create a LCD user interface that would inform the user of the suction level, report filter use time, and indicate to the end user when a service call is required.
2.2.1 Application of Theory	
Analysis	I used a current probe to plot suction vs. current in order to project clogged filter reduced suction levels. Determine the best algorithm to calculate True RMS current levels in a microcontroller environment.
Design and Synthesis	An inductor was specified to be able to read between 0-20 Amps. It was not required within the design to be able to read the higher inrush currents accurately, so the inrush of nearly 100 Amps was not taken into account when specifying the current transformer. In order to achieve consistent current readings I included in the design a zero-crossing signal from line voltage to the microprocessor. Monitoring the AC zero-crossing also allowed the algorithm to determine the systems line frequency as the device was made available in both North America and in Europe.
Testing Methods	Determined suction vs. current for multiple sized vacuum motors. Reduced suction was an indication of a clogging filter. An aperture restrictor plate was then fabricated to simulate different filter levels on standard vacuum motor sizes. A Fluke, true RMS, multi-metre and current clamp were used to validate the current calculation within the microcontroller.
Implementation Methods	The algorithm I designed had a configuration mode. In configuration mode the frequency of the system was determined to set the sampling period for the algorithm. The orifice restrictor plate was used to program the current draw under clogged and new filter conditions. The algorithm took 64 samples per AC line cycle. The algorithm used a sum of squares approach to calculate the motor's instantaneous true RMS current draw.
2.2.2 Practical Experience	
Function of components as part of the larger system.	The VacuVision was designed to be installed into central vacuum systems installed on 15 Amp systems. The motors in these systems were rated at 10 Amps. With higher inrush currents (up to 100 Amps) the consumer would be able to trip their circuit breaker during usual operation by repeatedly starting/stopping the vacuum. The solution was to design a product that fixed the problem and enhanced the system but would be modular and install easily into the existing vacuum power system. The product limited the inrush current to prevent its circuit breaker from heating and tripping.
Limitations of practical engineering and related human systems in achieving desired goals.	The maximum inrush current varied between motors. The inrush current was measured for a sample of 10 production motors. The maximum inrush experienced was then used as the operational inrush current; 1.5 times that value was used as the absolute maximum expected inrush current when finalizing the designs and selecting an appropriate bidirectional triode thyristor (triac). An inline fuse was added to the design to remove any issues associated with locked-rotor current overload conditions.
The significance of time in the engineering process.	The soft-start for motor control was designed to use a bidirectional triode thyristor (triac). The design did not monitor the AC waveform to determine when the zero current would be drawn by the motor. As such, the worst case scenario for inrush current needed to be taken into account when examining the expected lifespan of the product.
Knowledge and understanding of codes, standards, regulations and laws that govern applicable engineering activities.	In designing the electrical circuit boards I gained experience with North American and European electrical standards as this product was intended to be sold in both areas. IEC and CENELEC standards were followed throughout the electrical design of the circuit.
2.2.3 Management of Engineering	
Planning	The additional scope included an LCD display that would show the operator a suction level bar graph. The bar graph was populated using a percentage of full power current draw. As the vacuums filter becomes clogged the vacuum draws less current. Extensive planning went into the algorithm that would calculate true RMS current within a microcontroller and selecting a functional current transformer.
Scheduling	I scheduled my time for this project between motor testing, firmware development and circuit board design. Although the overall project had a nine month planned schedule, it was important that first release prototypes were manufactured within the first few months so that the client had time to review the functionality well prior to product launch.
Budgeting	The budget for the project was set between me and my manager. It was my responsibility to estimate the number of hours required for each section of the project. I was also involved in outsourcing a custom current transformer that would suit the needs of the project functionally and fit within the budget set for product manufacture.
Supervision	I produced specifications on how to construct the initial prototype built on a prototype board. It was my responsibility to supervise the development and electrical testing of these prototypes.
Project Control	The scope of the project changed several times to expand device functionality. Each time the scope changed I would restructure the cost estimates and produce updated project schedules and project outlines.
Risk Assessment	I tested the temperature increase of the triac during multiple starts to log its increase. The data was used to evaluate if a heatsink was necessary on the product to ensure an appropriate lifespan. It was determined that the triac was approaching its maximum operating temperature and I specified an appropriate heatsink for the TO-220 package through hole component.
2.2.4 Communication Skills	
Preparing Written Work	Operations manuals were created for the end user and the assembly facilities. It was important that these manuals were clear and precise as the assembly facility and on-site installers were required to use them frequently. They were used to calibrate the product to its motor to ensure that the proper current draw was used within the clogged filter algorithm. Monthly progress reports were submitted to my manager and the client's project lead throughout the project. Detailed documentation was prepared for both hardware and firmware logic.
Making oral reports or presentations	Meetings were held throughout the project to determine the scope, give progress updates and to finalize and launch the product with the client.
Making presentations to the general public	N/A
2.2.5 Social Implications of Engineering	
The value or benefits of engineering works to the public.	The engineering completed within this product allowed consumers (the public) to upgrade their central vacuum systems at a lower cost than upgrading their electrical circuits within their house. At the same time they would be given more information about their vacuum system; knowing when the filter should be replaced.
The safeguards in place to protect the employees and the public and mitigate adverse impacts.	Electrical standards were followed during design of the circuit board to ensure employee and consumer safety. Appropriate personal protective equipment was worn by all employees during development, testing and manufacturing.
The relationship between engineering activity and the public at large	The VacuVision is a product bought by consumers for use within their home. The safety of the consumer during design and development was taken seriously. Any mistakes within the design could lead to endangering public safety; the design was reviewed by a professional engineer to confirm design safety.
The significant role of regulatory agencies on the practice of engineering	IEC and CENELEC standards were important in protecting the consumer and manufacturer. These standards were followed which ensured electrical isolation during standard operation of the device. Double insulation spacing was used in the design of the circuit board to ensure consumer safety.

Post Graduation Experience	
Start Date	March 1, 2004
End Date	August 31, 2004
Company	**Micro Consulting Inc., Mississauga, Ontario**
Department	Industrial Electronics
Position	Electronics Designer
Supervisor	**Ignatius Michael Gomes, P.Eng. File Number: 16525016**
Client	**National Super Service (Toledo, Ohio)**
Product	**VING Portable Vacuum Controller**
Responsibilities	
	Re-design a DC vacuum circuit board that is failing in the field
2.2.1 Application of Theory	
Analysis	Using an oscilloscope and a current-sensing resistor (high power, low resistance) I examined the inrush current on motor startup. This peak current draw is important in selecting a proper device to switch motor power.
Design and Synthesis	The inrush current was used to examine different power switching methods. Power MOSFETs and relays were examined in detail for this purpose. Many iterations of the product underwent extensive testing. The design issue was to allow the battery powered vacuum to operate until the batteries reach a certain voltage and then stop operation to avoid damaging the batteries.
Testing Methods	I designed test firmware (embedded software) that would trigger the relay to power the motor, allow for the motor to reach its full speed, release the relay and allow the motor to completely stop. Wait times were measured and programmed into the test firmware. This allowed full inrush currents to be delivered across the relay contacts. The test firmware was designed to run 10, 000 cycles. After testing sequence was completed the relay enclosure was removed to examine the contacts.
Implementation Methods	After I found a suitable relay for the application, a system test was conducted with multiple product's at different battery charge levels. This quality testing not only allowed the product function to be verified, but served as an evaluation of product life-span.
2.2.2 Practical Experience	
Function of components as part of the larger system.	Throughout the entire design and testing stage the firmware focused on reliability. When the batteries have limited charge remaining, motor startup causes the batteries to drop below the relay coil dropout voltage. This causes a continuous startup cycle if precautions are not taken. While investigating the product's reliability, it was apparent that this dropout issue will cause the relay contacts to fuse if the operator does not discontinue use. As a result, the firmware was designed to monitor when the batteries are low, inform the operator, and not allow another startup until the batteries have been recharged.
Limitations of practical engineering and related human systems in achieving desired goals.	Battery voltage levels are measured using a voltage divider and an analog-to-digital convertor (ADC) channel to the product's microcontroller. The resistors in the design were 5% tolerance and the built in microcontroller voltage reference was used to power the ADC. Both these resistor and reference choices were cost cutting measures. As a result, calibration routines were required in the firmware so that the battery voltage could be accurately measured.
The significance of time in the engineering process.	Throughout the product reliability testing process, the lifecycle of the relay was approximated. Examining relay contacts after variable cycle test counts with variable battery charge allowed me to approximate the life of the relay under normal operating conditions. It also allowed me to advise the client on product lifespan for use in its marketing and sales departments.
Knowledge and understanding of codes, standards, regulations and laws that govern applicable engineering activities.	In designing the electrical circuit boards I gained experience with North American and European electrical standards as this product was intended to be sold in both areas. IEC and CENELEC standards were followed throughout the electrical design of the circuit.
2.2.3 Management of Engineering	
Planning	The size of the new design circuit board was limited by the original design. The cost of the final product needed to be of equal or lesser value than the original design to meet contract agreements.
Scheduling	I scheduled the research and development within the engineering department and meetings with the client to discuss possible solutions and associated production costs.
Budgeting	Required hours to investigate failure, redesign, prototype and test the new design were given to my manager at each stage of the investigation. These estimates were directly used to quote the project.
Supervision	N/A
Project Control	Several iterations of the design were developed and tested. Each time the project went in a different direction I had to re-adjust the schedule and allocate additional resources to maintain the agreed upon deadlines.
Risk Assessment	The original design contained a transient voltage suppression (TVS) on the silicon-controlled rectifier (SCR) switching circuit. On device failure, the TVS would fail-short allowing the vacuum motor to continue running until the batteries were drained or disconnected. The final solution that contained both a relay and MosFET was designed so that if any component happened to fail, the unit would cease to operate instead of continue to damage more parts.
2.2.4 Communication Skills	
Preparing Written Work	I created reports to detail my findings throughout internal failure testing. Manufacturing procedures were developed to modify existing product to have different switching technologies. Production documents were created to explain how to build and test the final product.
Making oral reports or presentations	N/A
Making presentations to the general public	N/A
2.2.5 Social Implications of Engineering	
The value or benefits of engineering works to the public.	The product was engineered to obtain the clients operational specification while at the same time maintaining consumer safety.
The safeguards in place to protect the employees and the public and mitigate adverse impacts.	Appropriate personal protective equipment was worn by all employees during development, testing and manufacturing. Electrical standards were followed during design of the circuit board to ensure employee and consumer safety.
The relationship between engineering activity and the public at large	N/A
The significant role of regulatory agencies on the practice of engineering	IEC and CENELEC standards were important in protecting the consumer and manufacturer. These standards were followed which ensures electrical isolation during standard operation of the device. Double insulation spacing was used in the design of the circuit board to ensure consumer safety.

Post Graduation Experience	
Start Date	October 1, 2003
End Date	February 28, 2004
Company	**Micro Consulting Inc., Mississauga, Ontario**
Department	Industrial Electronics
Position	Electronics Designer
Supervisor	**Ignatius Michael Gomes, P.Eng. File Number: 16525016**
Client	**Alutron Modules (Aurora, Ontario)**
Product	**RF Transmission Products**
Responsibilities	
	Research and develop a robust RF transmitting device (433 MHz) for commercial use in a small, cost effective device. Intended market was for European houses to be retrofitted with central vacuum units. In Europe it is not abnormal to have piping external to house walls, but still against code to have exposed electrical wiring; thus the need for wireless communication to control the vacuum.
2.2.1 Application of Theory	
Analysis	The signal strength and frequency was examined using a spectrum analyzer. It was found that the device was transmitting a strong signal within its 433 MHz operating range. Different antenna configurations were investigated using the spectrum analyzer. Range testing of the RF devices was also conducted outside (open-air, line-of-sight) to test the best configuration for both battery and 120V AC power operation.
Design and Synthesis	After detailed analysis and testing produced the best antenna configuration, I had to develop and design the product to acceptable manufacturing standards. The electrical design was done in OrCAD to produce the board house files for circuit board manufacturing. The circuit board's shape was constrained to its vacuum handle housing, a 1x3 inch area, adding additional difficulty to the electrical design. Small piggyback boards were designed to expand the available space for electronic components.
Testing Methods	Range testing was done in various areas; within industrial buildings, in clear line-of-sight, and residential areas. The results were documented using several different antenna configurations (loop, single pole) as well as different component configurations to tune the signal power output.
Implementation Methods	The finalized product moved into immediate production. I created manufacturing procedures to assure product quality standards. I was also solely responsible for the programming of the automated optical inspection machine to review each component on the circuit board, and to ensure this program was valid, up-to-date, accurate and reliable.
2.2.2 Practical Experience	
Function of components as part of the larger system.	The RF transmitters were a small part of a functional vacuum hose and central vacuum system. The same device would be installed in vacuum hose handles, in floor-mounted vacuum dust pans and at the vacuum canister. The circuit board was designed to have variants that would either make it a transmitter or receiver depending on the components installed. This reduced overhead costs and manufacturing costs while delivering the product to the consumer at the best price available.
Limitations of practical engineering and related human systems in achieving desired goals.	Although the Micrel RF component datasheets specified that the product range was 600ft, it was found and understood that this was under ideal conditions. The final product was tested in open-air up to 550ft, nearly 92% of the optimal distance.
The significance of time in the engineering process.	N/A
Knowledge and understanding of codes, standards, regulations and laws that govern applicable engineering activities.	In designing the electrical circuit boards I gained experience with North American electrical standards. I also gained knowledge as to what frequencies and transmission power rates are allowed through rules outlined and enforced by the FCC.
2.2.3 Management of Engineering	
Planning	At the beginning of the project I developed a plan to effectively and efficiently maximize the range of the RF device. It detailed how to test the devices with the spectrum analyzer, how to measure the affects of AC power near the electronics and created a system to test the range outside with only one employee.
Scheduling	I created task schedules for the project to keep research and development streamlined and on track. It was my responsibility to adhere to the schedule I outlined in order to stay within budget.
Budgeting	A time/cost estimate was given to my manager at the beginning of the project. It was then my responsibility to schedule my time and my colleague's time on the project to fit within this budget.
Supervision	N/A
Project Control	Manufacturing procedures were continuously updated throughout this design. Through manufacturing corrective actions the production procedures were updated to reflect the changes in the design.
Risk Assessment	N/A
2.2.4 Communication Skills	
Preparing Written Work	Weekly reports were created to detail the findings of each tested configuration. The product was initially only reliable for 100 feet in open air, 35 feet through cement walls, so progress reports were critical in the continuation of the project. Production documents were created to explain how to build and test the final product.
Making oral reports or presentations	N/A
Making presentations to the general public	N/A
2.2.5 Social Implications of Engineering	
The value or benefits of engineering works to the public.	N/A
The safeguards in place to protect the employees and the public and mitigate adverse impacts.	Appropriate personal protective equipment was worn by all employees during development, testing and manufacturing. Wiring was exposed during testing of the AC power models, so proper insulating gloves were used during this testing. Safety glasses and hearing protection were also used when necessary.
The relationship between engineering activity and the public at large	N/A
The significant role of regulatory agencies on the practice of engineering	IEC standards were important in protecting the consumer and manufacturer. The rules outlined by the FCC are important in order to maintain fair opportunity between competition.

Pre-Graduation Experience	
Start Date	May 1, 2002
End Date	August 31, 2002
Company	**Bateman Equipment Corporation, Newton, Ontario**
Department	Feed Mill Automation
Position	Junior Automation Designer
Supervisor	**P. David Paradis, P.Eng. File Number: 90343799**
Client	**Shur-Gain**
Product	**Feed Mill HMI**
Responsibilities	
	Create a Human-Machine Interface (HMI) to control feed mill silo automation upgrades
2.2.1 Application of Theory	
Analysis	
Design and Synthesis	The HMI was developed to the clients graphic standards so that there were minimal differences between terminals within the mill. The clients standard graphics and animations were adopted within the application.
Testing Methods	I created a detailed testing sequence to verify correctness of the HMI. I tested each interface reference point through PLC simulation.
Implementation Methods	I installed the HMI computers within the plant. Additional site visits were required for maintenance on existing HMI computer systems.
2.2.2 Practical Experience	
Function of components as part of the larger system.	The HMI is the visual representation of the operation of the plant. As such, I had to be familiar with the entire plant function and operation in order to design a proper graphical representation within the HMI.
Limitations of practical engineering and related human systems in achieving desired goals.	N/A
The significance of time in the engineering process.	N/A
Knowledge and understanding of codes, standards, regulations and laws that govern applicable engineering activities.	N/A
2.2.3 Management of Engineering	
Planning	Prior to developing the HMI application I researched the system requirements to plan what applications, I/O drivers and hardware would be required. I also mapped out the general idea of the application so that it could be reviewed by the client prior to in-depth development.
Scheduling	As a summer student it was important that I stuck to a schedule and left the job with a complete system. I followed a schedule put forward by the senior engineers on the project.
Budgeting	N/A
Supervision	N/A
Project Control	N/A
Risk Assessment	N/A
2.2.4 Communication Skills	
Preparing Written Work	Operators manuals were created. These manuals were used during training sessions on-site and to teach future employees the basics of the HMI. Common troubleshooting documents were prepared to resolve any PC issues.
Making oral reports or presentations	Training sessions were held to educate employees on how to use the HMI and how to troubleshoot minor issues.
Making presentations to the general public	N/A
2.2.5 Social Implications of Engineering	
The value or benefits of engineering works to the public.	N/A
The safeguards in place to protect the employees and the public and mitigate adverse impacts.	All employees had to use the appropriate personal protective equipment in line with site specific health and safety plan.
The relationship between engineering activity and the public at large	N/A
The significant role of regulatory agencies on the practice of engineering	N/A