Internship Report

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Data Science and Analytics Program

PSM 691 – Internship
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Site: Dematic Corp.

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Summer 2022 – Winter 2023

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Internship Objectives

My internship objectives evolved from summer 2022 to winter 2023 as I continued my internship for 3 consecutive semesters.

The Objective of the internship during summer'22 was to complete the onboarding process in Dematic, which consists of 320 hours of training and then hands-on experience. The training consists of courses on safety, privacy laws, workplace culture, conflicts of interest, HR policies, products, etc. The hands-on experience involves working as a team member on an ongoing project and understanding the workflow practices. The actual objectives differ in some areas from the objectives declared in the original call for hire. Nevertheless, the original objectives are as below –

- Create elegant solutions for some of the most complex material handling and logistics projects in the world
- Deliver large, impactful, and meaningful enterprise projects while working in a small, nimble, and flexible start-up environment
- Develop high-quality code and unit tests – we love testing!
- Collaborate with highly cross-functional, Agile teams to build out new customer features and functionality
- Play a critical role in system design, architecture, and execution
- Travel across North America to customer sites to validate system functionality and testing (approximately 20%)

The objectives of the second part of the internship in Fall'22 was to effectively utilize my understanding gained till now and apply those in the success of the project. I was required to not only deliver the work but also collaborate with team members, plan, and manage work, communicate with customer when on site etc. This portion of the internship objective was to help me grow and become capable of taking on the daily challenges at work.

The objectives of the last part of the internship experience in winter'23 was to take on multiple projects and expand my understanding across teams and roles. This included managing post deployment customer requests and services, customer training, internal training, cross-team project work etc. This part of the internship helped me hone my interpersonal skills, management skills and project execution skills.

Introduction

The Professional Science Master's program at GVSU requires graduate students to complete at least 1 credit of the Internship course. The main objective of the PSM program is to learn teamwork, professional skills, real-world problem-solving, communication, networking, and scientific and technical skills in a professional environment.

I have worked at Dematic Corporation at Grand Rapids, as part of the degree requirement during the Summer'22, Fall'22, and Winter'23 semesters. The work is remote with occasional site visits and comes with many unique challenges and learnings.

The scope of my work in the summer'22 semester can be divided into two parts. Each employee of Dematic undergoes extensive training that can take as much as 320 hours, depending on the role. After the training, the team I'm working with assigns new employees to an ongoing project to complete the learning and onboarding process. I completed 320 hours of training and then worked with a team on a project.

As a part of the new hire training, I've completed 34 courses. Some of the noteworthy courses are –

- Harassment Prevention
- Dematic Environment, Health, Safety and Sustainability Policy
- Safety Orientation
- Preventing Anti-Competitive Practice
- Intellectual Property at Dematic
- Avoiding Conflicts of Interest
- General Data Protection
- Information Security
- Introduction to LEAN
- Software training for Projects
- Introduction to Forgiveness Meditation

The impact of these training courses on my professional growth is detailed in the Description section.

During this period, I've also worked on a project for **"Southern Glazer's Wine and Spirits of America"**. They are the largest wine and spirits distributor in the United States with operations in 35 states. The project involved warehouse automation for their many warehouses, Dematic platform upgrades, and overall optimization of their warehouses. Each warehouse handles large quantities of orders each day and is managed by a suite of products from Dematic.

My work in this project involved warehouse data storage and retrieval, data visualization and reporting, optimization of storage solutions, developing new data summarization and visualization interfaces, and getting a grasp of how a large amount of data flow daily in the warehouse for its smooth operation.

During the Fall'22 semester, the scope of my work expanded to include different responsibilities of the project. During this period, I get to visit the Southern Glazer's Wine and Spirits warehouse in Columbus, Ohio multiple times. One objective of these travels was to expose me to the daily operations of the warehouse and see how my work fits into the bigger picture.

This portion of the internship also included taking on personal goals and team goals that required me to collaborate with teammates in improving the daily work environment across teams. A detailed description of the work and my performance is included in later sections.

The third and final part of the internship during Winter'23 had me complete a few major milestones. I was heavily involved in the completion of the Southern Glazer's project and after-completion support. During this time, I was also onboarded on a second project that is being considered a major undertaking for the company. This new project is for one of Dematic's continued customers and renowned brand **"Carhartt"**. The warehouse is located in Dallas, Texas.

My work in this project is to learn cross-team skills and expand the capabilities of my team. I am to take on a part of the project that is traditionally been done by another team and see it to completion. The full description of the work is in later sections.
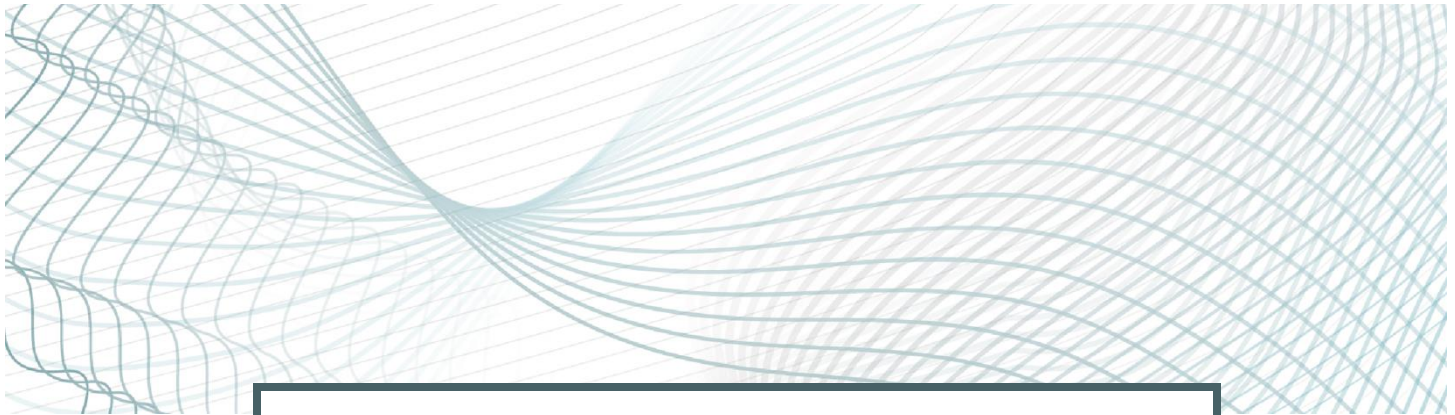
Description of Work

Summer 2022

The internship experience and description of work are described in two sections. The first section involves an overview of some of the training courses I've completed. The second section details my work on the project I was involved in. Each section gives a summary of the work, my learnings, and my growth as a professional.

Training

- General Data Protection:

Dematic Corp. is under the KION group of industries. KION is one of the world's leading providers of forklift trucks, warehouse equipment, and supply chain solutions. KION is a European company and follows the data protection and privacy rules enforced by the EU.

In this training, I learned how **EU General Data Protection Regulation (GDPR)** protects and upholds the data of customers. I've also learned the dangers of data handling and security risks. This course covered how consent should be taken from customers under the GDPR, what security measures Dematic must ensure, ethical issues in data sharing, and the data rights of the customers.

Being a student of Data Science and Analytics, this course has given me a new appreciation for data protection regulations and the necessity of those regulations.

This also helped me learn how a large corporation handles data and ensures its security.

- ## Information Security:

This training course is designed to bring awareness to the cyber-risks when dealing with company-owned software and hardware. The course focuses on the knowledge and practices required to ensure the secure handling of sensitive data and to help recognize security risks during everyday work.

As a remote employee, it becomes complex for the company to control a safe working environment and reduce the cyber-risks of data breaches. This course trained me in handling software, hardware, data, and other sensitive information outside of the office environment.

With the increasingly remote nature of professional environments, I must know how to protect the information and interests of the company. This course has made me aware of the risks involved in working in different environments such as home, coffee shop, transportation, etc.

- ## Introduction to LEAN:

The LEAN practices can significantly improve any process of work. In a professional carrier, it changes the outlook of how we manage our work. It can optimize every aspect of an employee's professional and private life.

This course has changed how I approach any work, be it making a toast or designing a solution. The course also teaches how Dematic practices LEAN and how I can actively participate in improving the process.

- ## Harassment Prevention:

This course teaches more than just the harassment laws – it teaches how to act as a professional to create a safe environment where professionals feel comfortable performing at their best. This teaches Dematic's values and culture on harassment prevention, consequences of our unconscious behaviors, and ways to stand up for what's right.

I've learned the subtle ways of detecting workplace harassment and ways to prevent it professionally. I also learned about the laws and cultural policies that prevent workplace harassment.

- ## Preventing Anti-Competitive Practice:

Competition law protects the free market economy from restrictions from the participants themselves. It protects the market from cartels, price fixing, boycotting, and monopolies.

KION and its subsidiaries adhere to the Competition laws and aggressively ensure that no employee prevents anti-competitive practices. This course taught me the fine line between being professional and engaging in anti-competitive behavior. It gave ample examples of situations to illustrate how a simple gift can be perceived as an indirect pressure to engage in anti-competitive practices.

- ## Intellectual Property at Dematic:

Dematic has many patents and trade secrets that they protect. As an employee, I get to learn about these intellectual properties. So, protecting the company's interest is vital to Dematic. This course introduces the concept of IP and gives an overview of the IPs Dematic possesses and the steps the company and the employees should take to protect them.

I understand that as I grow as a professional, I'll need to work with many such IPs. So, knowing how they are protected gives me an understanding of how to handle such properties professionally.

- ## Avoiding Conflicts of Interest:

Conflicts of interest are ethical issues that each professional must be aware of. Professional business decisions must not be biased by personal interests. The nuances of when a COI takes place are hard to detect but the consequences of COI are dire.

To grow as a professional, it is a must to learn how to avoid COI. This training was of vital importance to me in learning about the subtleties of COI and how severe the consequences can be for me and the company.

Project Work

The project work I was involved in can be divided into three sections. My work on Data storage systems, APIs for ingesting and transforming data, and Data presentation.

My previous experience as a software engineer and my current ongoing learnings in Data science has been fully used in this project. I've learned and worked on how the data is stored, processed, and presented in a highly dynamic and real-time environment like a warehouse. The description of my work for each portion of the project work is described below.

Data Storage Systems

It is important as a Data Science student to learn how data storage solutions work in industries. The real-world knowledge of data storage and retrieval systems can give me insight into how to design, develop and maintain such a system. It can also help me understand the risks and pitfalls of designing large-scale data storage solutions.

Dematic uses Microsoft SQL Server for data storage and processing. These servers are hosted in the Azure Cloud platform in separate VMs for the duration of the project. Once the project is completed, the system is either transferred to an in-house server or a privately maintained Cloud server.

The Data is mainly stored in tables and manipulated using database stored procedures. Many optimization techniques involving RDBMS are used to maintain a high throughput of data. The fast-moving packages in conveyors go through multiple checks and routings based on the socket communication between the PLC and the SQL Server.

There are multiple database procedures to summarize and archive data once a work shift finishes. These data are then stored in Data warehouses for further analysis.

For this project, I've worked on writing more than 10 database procedures that update and control the flow of data within the tables. I've also built 10-plus data presentations and reporting database procedures for this project. The confidential nature of the project requires that I do not share exact information about the database procedures I've written for the project.

APIs for Data ingestion and presentation

Another large portion of working with data is the APIs that are used to ingest and retrieve the data. The knowledge of how to work with APIs, and how to design and develop new APIs are vital for the success of a Data science and analytics student.

This project used a NodeJS based API middleware that connects to the SQL Server. This middleware is responsible for exposing APIs that are used to update, control, summarize, retrieve, and disseminate data among the various components of the system.

Every design choice of the API middleware for the best performance has been a learning experience for me. I've also learned the importance of having a robust API service. This project required me to develop multiple data ingestion and exportation APIs. I've also developed a completely novel way of data export API for this project.

Data Presentation

Another important portion of DSA is the analysis, visualization, and reporting of the data. This involves data presentation in an easily consumable format. Any complex system requires data reporting to monitor and control the system.

I've worked on developing a few very important data presentations and visualization screens in this project. These screens/UI range from a simple presentation to a complex dashboard with a large amount of statistical analysis of data using SQL Server stored procedures, APIs and UI. Some of the work I've done in data visualization is given in the screenshots below. For each of these few examples, I've built the whole system, from data storage, processing, and API to data presentation.

Hour	15	16	17	18	19	20	21	22	23	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Pick Modules	4	1	77	19	0	158	8	10	5	0	7	35	116	78	7	10	58	34	32	31	37	28	64	89
Shipping Sorter	10	58	34	32	31	37	28	64	89	4	1	77	19	0	158	8	10	5	0	7	35	116	78	7
Dock Doors	31	37	28	64	89	4	1	77	19	0	158	8	10	5	0	7	35	116	78	7	10	58	34	32
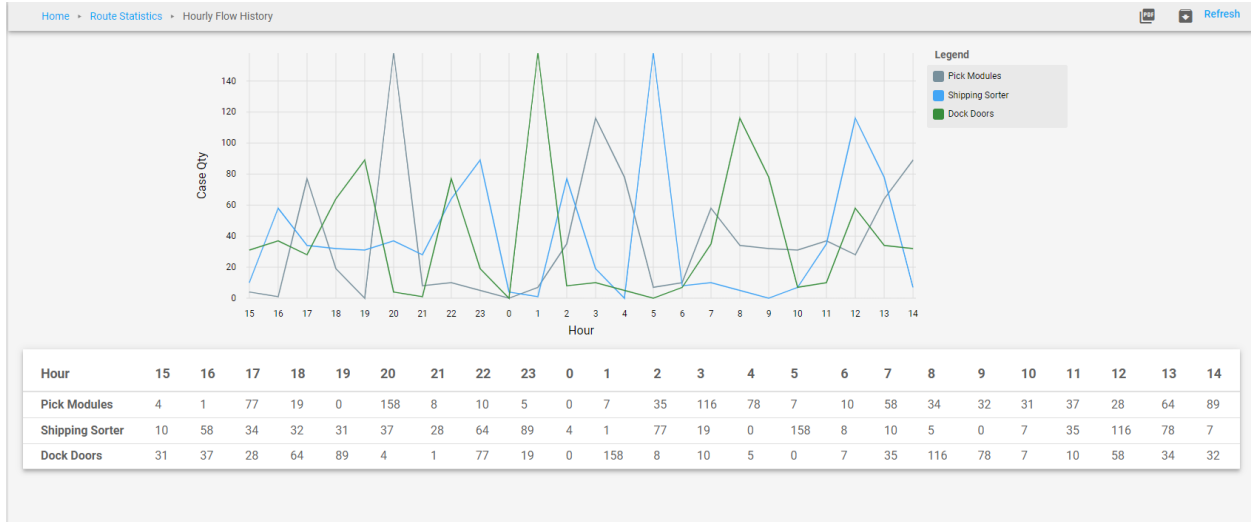
Figure 1 Displays the Hourly status of different sections of the warehouse. This information is formed using complex database queries and procedures

Door	Full Lane Duration	Loaded	15	16	17	18	19	20	21	22	23	0	1	2	3	4	5	6	7	8	9	10
Total	26:21	1600	566	369	166	266	366	1287	466	366	620	1470	167	290	200	237	754	234	330	1210	246	1032
7	01:01	500	522	323	122	222	322	247	422	322	500	444	123	234	156	179	252	190	290	280	202	320
5	02:20	550	22	23	22	22	22	520	22	22	60	513	22	28	22	29	251	22	20	465	22	356
4	23:00	550	22	23	22	22	22	520	22	22	60	513	22	28	22	29	251	22	20	465	22	356
Total	26:21	1600	566	369	166	266	366	1287	466	366	620	1470	167	290	200	237	754	234	330	1210	246	1032

Figure 2 Displays the Hourly status of different conveyors in the warehouse

Download Overview

Routes	Customers	Stops	Sales Orders
22	583	77	1355

Full Cases	Bottles	Pallets	Non-Cons
31018	1662	5	91

Full Case SKUs	Bottle SKUs	Pallet SKUs	Non-Con SKUs
604	613	3	1

Full Case Summary

Legend: Bottle, Case11, Case12, Case21, Case31, Case32, Other

Module	%	Labels Created	Cases Loaded
Bottle	3.7%	1662	0
Case11	51.1%	22753	0
Case12	15.5%	6921	0
Case21	26.3%	11731	0
Case31	1.8%	799	0
Case32	1.2%	550	0
Other	0.3%	151	0
TOTAL	100.0%	44567	0
DIFFERENCE			44567

Bottle Room Summary

Legend: FLOW RA..., SHELVING, ODDBALL, HVAL

Area	%	Bottles Expected	Bottles Packed
FLOW RACK	54.1%	1608	1375
SHELVING	45.9%	1365	1321
ODDBALL	0%	0	0
HVAL	0%	0	0
TOTAL	100%	2973	2696
DIFFERENCE			277

Overall Shipping Case Summary

Legend: PALLETS, ODDBALL, FULL CASES, NON CONVEYA..., SPLIT

Case Type	%	Cases Expected	Labels Created	Cases Loaded
PALLETS	0.0%	0	5	0
ODDBALL	0.0%	0	11791	0
FULL CASES	0.0%	0	31018	0
NON CONVEYABLE	0.0%	0	91	0
SPLIT	0.0%	0	1662	0
TOTAL	0.0%	0	44567	0
DIFFERENCE				0

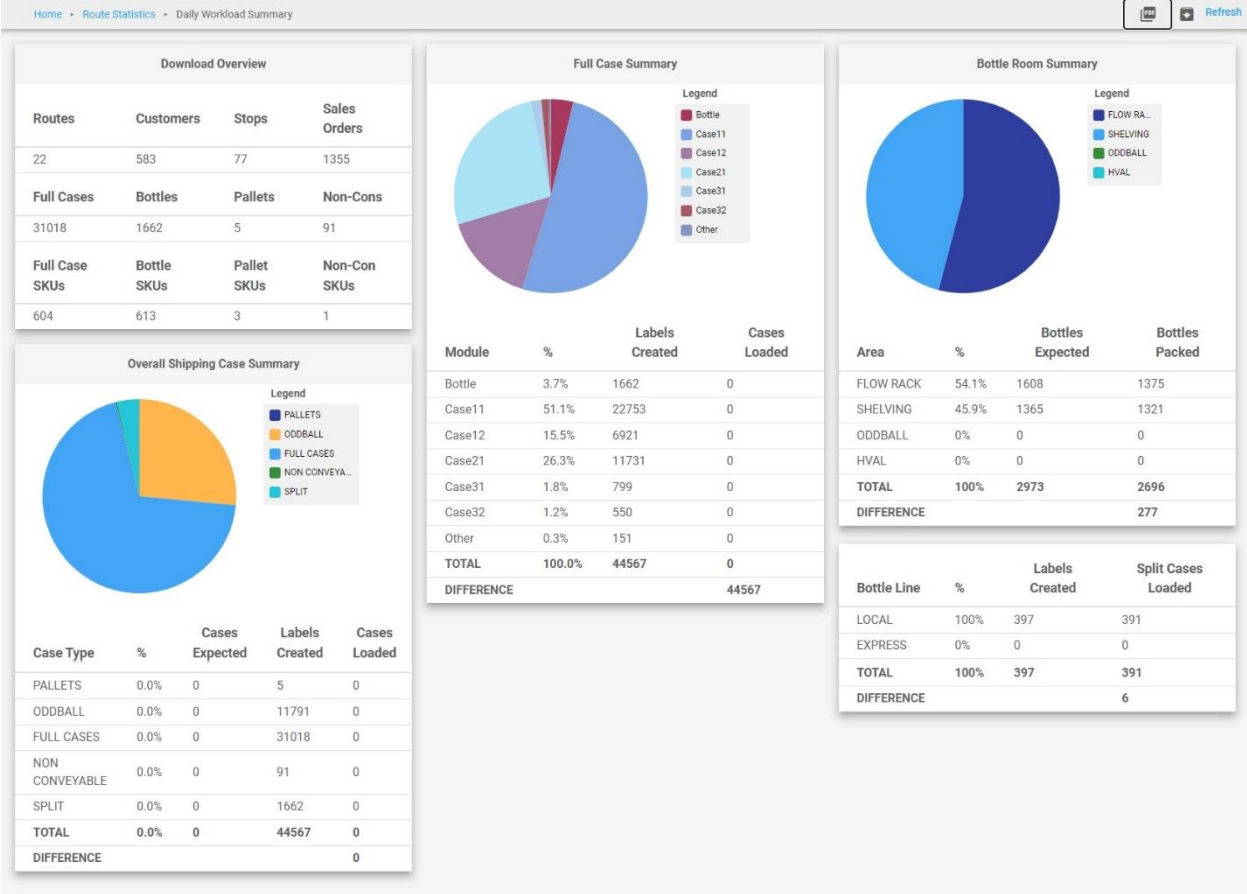| Bottle Line	%	Labels Created	Split Cases Loaded
LOCAL	100%	397	391
EXPRESS	0%	0	0
TOTAL	100%	397	391
DIFFERENCE			6

Figure 3 A dashboard showing statistics across the whole warehouse using different analysis and 5 very complex procedures. The whole system, from data storage, processing, API and presentation was developed by me

Fall 2022

This portion of the internship involved both Team and Project work and therefore is also divided into two sections. Each section explains the personal and professional growth I achieved during this period.

Team Goals

As a team, we are responsible to take on additional tasks that can help other teams become more efficient. Every 10 weeks as a team we decide on at least 3 goals to pursue that can act as a multiplier for other teams. This requires soft skills like communication, collaboration, and negotiation as well as hard skills like documentation, training sessions, etc.

During this period, I collaborated on two major team goals from start to finish. I've also collaborated with others on my team to help them complete their goals. One of them was promoting the use of the "**RedGate Source Control**" tool to efficiently manage database changes across the team. This required me to research the tool, create documentation and how-to guides, collaborate with teammates to examine the feasibility of the tool and participate in training other teams on the use of the tool.

The second noteworthy goal I accomplished was to build a "**Progression Status Visualization**" that shows a carton's flow in the warehouse. As a team we collaborated in designing the UI, taking feedback from other teams, and successfully deploying it as a part of the project.

These activities not only helped me hone my interpersonal skills but also helped me acquire a good understanding of how to bring positive change at work. The collaboration opportunities I got helped me get comfortable in asking for help and understanding the strengths of my team. The training sessions I facilitated have given me the confidence and inspiration to be a positive multiplier for the team.

Project Work

The project work involved the continuation of the project I worked on during summer'22. I also got the chance to visit the warehouse and interact with the hardware that is controlled through the software. This portion of the work can be

divided into two parts. One is the continued improvement of the project towards completion and the other is the hands-on experience gained from the site visits.

Improvements

This portion of the work involved a major rewriting of the data presentation screens/UI. The changes are mainly done to incorporate the ability to visualize historical data for each of the 9 screens. The change required me to rewrite the data processing procedures and write additional procedures to support the saving and retrieval of historical data.

I also participated in testing and bug-fixing multiple mission-critical aspects of the software such as data storage at the end of the shift, readying the system for next-shift data, testing the planning and printing of labels, etc. I was also required to improve the data processing code for multiple other screens to facilitate customer needs.

To accomplish these tasks, I needed to be proactive in asking questions, collaborating with teammates, communicating, understanding the requirements, plan and executing the tasks on time. Through this testing and bug fixing I acquired a deeper understanding of the software and different components. I also understood how the different parts of the database relate to each other.

The skills I acquired through my work in improving the software to customer specifications are mostly hard skills. But the soft skills I learned are equally valuable in my growth.

On-site Experience

Part of the work in this period was to visit the site and gain an understanding of the hardware used during the lifecycle of the project. The initial visit was for 3 days that required me to get in contact with Dematic employees on site. I get to see the hardware in action, see how the data I work with gets generated, and how the customer uses the data to make decisions. I've also helped my teammates test some of the features on the hardware while I was there.

This visit helped me get in touch with the other part of the warehouse automation and the people involved. I get to meet Dematic controls engineers and customer representatives there. Talked and learned about different devices and what happens

when we push a button on the UI. This visit has been a very good learning experience for me and given me the opportunity to expand my network.

Winter 2023

My internship at Dematic continued in winter 2023. As I mentioned earlier this part includes two major milestones, I achieved during my time at Dematic. The first milestone is the successful completion of the "**Southern Glazer's Wine and Spirits**" project. The second portion is my onboarding and work on a high visibility project for "**Carhartt**".

Completion and Support

As part of the completion of the project, I had to complete all tasks and testing before the deadline. I also visited the site twice, once to test our software and another time during the first week of production for customer support and training. The post-completion support had me work on patches and bug fixes.

We as a team went through extensive testing of the software before they go live. This involved full-day collaborations with multiple teammates, regular feedback, and checks. During this period, I get to experience how the whole team comes together to deliver a quality product to the customer. I also got an understanding of how the project is managed at different levels in the organization.

As part of this extensive testing, I visited the site to be present and help controls engineers test the hardware. I got the chance to work with many great people working at Dematic and met with customer representatives. I also trained the representatives on how the system should be used and took feedback on how to improve some parts of the software.

The second site visit was during the first week of production at the new site. I got to collaborate with the whole Dematic team and the whole customer team. I acted as a standby support and go-to person for any questions or concerns the customer had during this crucial period. I also worked on actively patching the system with critical updates and helped customers run the process smoothly.

After production started, I was responsible for additional improvements and fixes. I was also responsible for updating production software which required me to maintain strict protocol and visibility. I was also responsible for designing and

optimizing end-of-shift data processing job that handles a large volume of data and processes those data for later consumption.

I had tremendous growth during this period of work. I get to meet great professionals, saw their dedication, and learned from their communication and collaboration skills. I've also understood different aspects of customer expectation management, and post-deployment conversations.

New Project Onboarding and Work

During this period, I was also onboarded into a new project. This project involved multiple new technologies and hardware integrated into the software our team is responsible for. The project is a large warehouse automation for "Carhartt" located in Dallas, Texas. Being a high-visibility project multiple people from different parts of the organization require periodical updates on the progress. Thus, the responsibility to deliver superb quality software is upon our team.

Since this project will incorporate technologies that are new to our team's software, there are multiple parts of the project that, as a team, we don't have any experience developing. One such part involves the picking system. In short, this system handles order data and directs workers in the warehouse to pick appropriate items for the order. A different team used to take care of this part. I'm responsible for developing this part of the project. Therefore, I need to communicate and collaborate across teams and acquire knowledge from multiple sources. I'm also responsible for documenting everything I learn so that the knowledge can be transferred to other team members in the future.

In the last project, I didn't get visibility on how a project is launched and all the steps involved in successfully starting a project. This time I get to see and acquire this valuable lesson. I also get to learn to collaborate with different teams and learned how to effectively transfer knowledge. Both the soft and hard skills I get to polish during this semester will surely be very valuable in my future carrier.
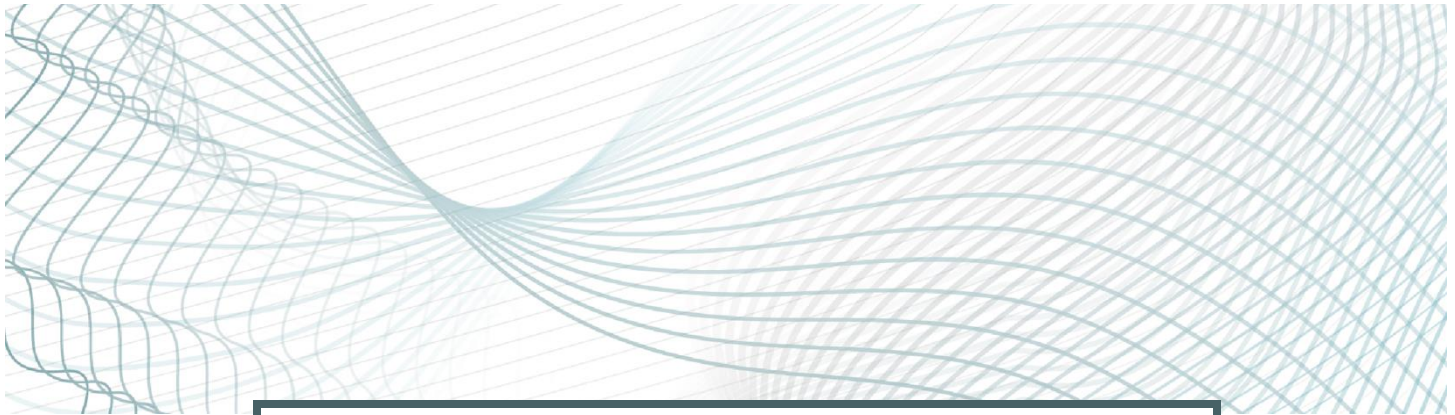
Internship Discussion

The objectives of my internship were successfully achieved. I've finished all the required training, worked on a project team, and got to learn about the different technical aspects involved in a successful project.

Through the training, I've learned about company culture, laws and regulations, and ethical and moral restrictions involved in a professional career. I've learned to better communicate within and across teams. I've also polished my task and work-life balance management skills. Working on the projects gave me an in-depth understanding of the workflow in a warehouse. I've also learned how the data is collected, stored, processed, displayed, and archived. The client meetings I attended gave me insights into customer management and communication.

Not completing PSM 662 course before starting this internship would've been a major hurdle for me. The insights I gathered in that course about teamwork, communication, networking, and responsibilities have guided me throughout my internship. The knowledge from the CIS 660 course was also invaluable. The whole data handling portion of the project was guided by the knowledge I acquired in that course.

I faced a lot of challenges during this internship. The main challenge was in communication due to the remote nature of the work. To overcome that I didn't hesitate to ask for help whenever I got stuck and remembered to thank others for help received. I also tried to keep my camera on during meetings whenever possible. Apart from that I actively updated my supervisor on the progress and schedule of the tasks I'm responsible for. Transparency was key to building a comfortable and trusting work environment. Overall, I am happy with my professional growth, skills acquired, and experience gathered in this internship.

Conclusion

I've achieved growth in all aspects of my professional skills during the internship experience. While I've had many opportunities to express myself and absorb advice from experienced professionals, I feel like I still have more to learn. The skills I've gathered during my internship at Dematic show me the improvements I need to achieve. The more I learn, the more I can find opportunities to grow myself.

My time at Dematic has given me a new appreciation of the importance of good office culture. I've achieved so much during these short 3 months only because of a good culture and great teammates. I'm confident now to handle any reasonable responsibility I'm assigned and that is only possible because of my growth as a professional.

I'm grateful for the PSM courses I've had the opportunity to complete before going into this internship. They have adequately prepared me to face the challenges of a professional career. I'm also thankful for the opportunity to work at Dematic and the opportunities to learn from the very best professionals in their fields. It has been a great experience.