

UNIVERSITY OF WATERLOO
Faculty of Engineering
Department of Electrical and Computer Engineering

The Canada-Japan Co-op Program

Experiential Work Report

Wireless Systems Innovation Laboratory
NTT Network Innovation Laboratories
Nippon Telegraph & Telephone Corporation
1-1Hikarinooka Yokosuka-Shi Kanagawa 239-0847 Japan

Prepared by
Minil Yun
ID 20198171
userID m2yun
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During my CJCP intership, I was hired by NTT Corporation, Wireless Systems Innovation Laboratory, with a position of researching student. My research topic mainly included wireless communications and the latest wireless technologies. The employer, NTT Corporation aims to create an enriched and more fulfilling social environment through use of information communication technology as well as creating new businesses and offer various new approaches to communication based on R&D activities. The history of NTT goes back to when it was first established as a government-owned corporation. The company was privatized in 1985 to increase the competition in the telecommunication market. Despite that it was intended to create competitions, NTT Corporation still dominates the telecommunication market in Japan and has become the second largest telecommunication company in the world. As NTT is a group corporation, it hold many companies. NTT DoCoMo is a well-known cellular service provider that holds the largest number of subscribers in Japan. The picture below is the laboratory where I was placed in.



The work that I have done during my internship can be divided into three main categories. I acquired knowledge in principles of wireless communication. Then I acquired knowledge in principles of MIMO technology followed by researching MIMO in Multicell environment. Studying principles of wireless communication was done by reading text books and understanding Matlab codes that my manager (Dr.Nishimori) has shown me. Studying principles of MIMO technology was mainly done by running Matlab simulations and understanding the plots. As well as IEEE and other professional organization documents had to be read. The documents were based on MIMO research. When researching MIMO in multicell environment, there were not enough resources for me to reference because of the topic being very new and not enough research has been done in the past.

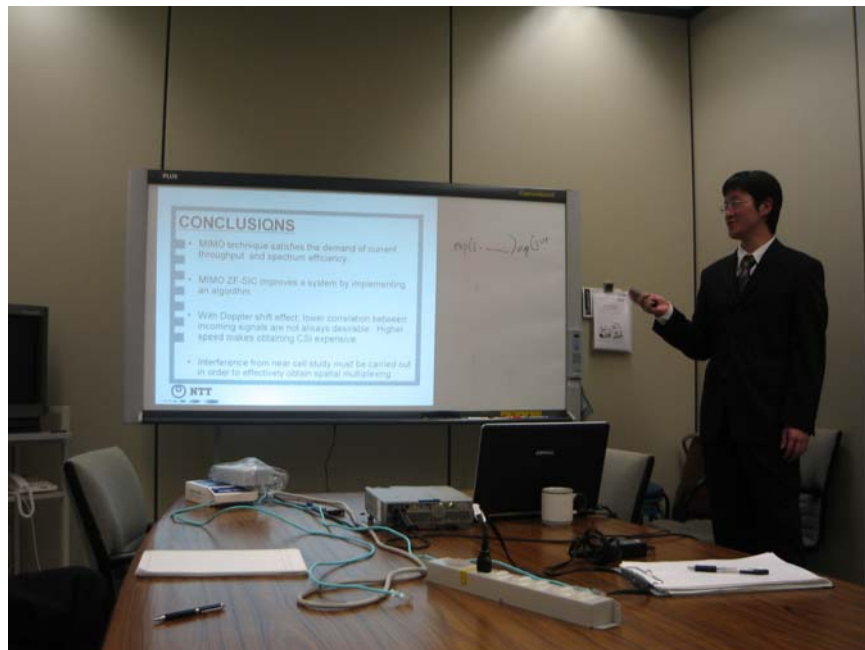
My role in the department is to research on MIMO technology. I created Matlab simulation files which evaluates basic performance of multiuser transmission. Every week or every two weeks, I submitted my progress or result of my research.

The laboratory where I was placed, called Wireless Systems Innovation Laboratory, currently performs R&D on MIMO, Antenna, Radio Frequency/Monolithic Microwave Integrated Circuit, and Software Defined Radio. Our department is responsible for providing research and possibly obtaining patents of the latest technologies. With the increasing demand in wireless communication, our department are currently focusing on how to use the wireless communication other than the cellular network. Installing

wireless transmitters and receivers at all vending machines has been proposed. Also electromagnetic waves with wavelength in micro level are now being researched. Since physical size of an antenna is proportional to the wavelength, shorter wavelength makes it possible to manufacture smaller antennas. With smaller antennas, we have reduced the size restriction and can open up the wireless market.

The knowledge that I have acquired during this internship is mostly the principles of wireless communication and MIMO. I've been reading textbooks and research papers that are related to wireless communication. With the help of my managers Matlab codes, I got to a level where I was able to create my own codes simulating a wireless communication environment. Also my presentation skill was practiced during the intership as I had to present my studies and researches at the end of my internship. The technical report that I have written has also improved my skills on writing reports.





Other than skills acquiring from the work place, I also joined a Japanese language class every Wednesday after work. Teachers were mainly volunteers and offered very cheap lesson fee (1000yen/10 sessions).

From this Canada-Japan Co-op Program work experience, I gained a valuable experience that will help my future studies and career goal. I've decided my career goal to work in the wireless industry since from my first co-op term at Rogers Wireless. With a great experience from NTT, it's something that is worth to put on my resume and for sure it will benefit myself on finding my next internship. I was very fortunate to be hired by NTT and I thank CJCP for helping me through the hiring process. The research that I have done here will definitely help in my studies at the University of Waterloo. The textbooks that I have read here are the textbooks that will be used in the courses that I'm planning to enroll.

It's an advantage for me since I have already covered most of the chapters and know few theories and principles before going into the class.

Relationships with my Japanese co-workers have been great. They were more than my expectations. They helped everything from my first day to my last day of work. I really appreciated how my boss came out to the airport and took me to my dormitory. I still remember my second day in Japan, when my boss invited me to his place and his wife prepared lunch for me. She was pregnant at that time and really appreciated their help and kinds. My manager also helped me on getting the alien card and opening my bank account. Getting the alien card and opening a bank account took really long time but he was very kind to leave his work behind and help on my work. Another co-worker, also helped me alot. I should thank him the most because he would come to me after work to my room if I had any problems. I had a problem with my internet connection and he came to my room after work to have a look. He also helped me getting the re-entry permit few weeks ago. I also enjoyed my lunch time because one co-workered offered me if I wanted to paly ping-pong. So during the lunch time, I usually spent my time playing ping-pong with him and have conversations asking him to teach me Japanese words. I should also thank a co-worker who introduced his friends in my first month in Japan. He tried to introduce his Japanese friends to me. Also a co-worker from another group introduced his sister to me and it turned out that his sister's boyfriend is currently studying at my university. Then when I became friends with them, the sister introduced me her friends to me and made new Japanese friends. It was like after getting to know one person, you get

to know the person's friends and friend's friends, and friend's friend's friends, and a sister.

One of the greatest but also the most tiring experience was climbing up the mount Fuji. Me and my other two friends planned out schedule to get to mount Fuji but never planned how to climb up the mount Fuji. So it turned out that we had to climb from the bottom of the mountain when most people take a bus to the 5th station (Fuji has upto 10th station being at the top of the mountain) and start climbing from there. Also we chose to climb in October which was still a warm weather down in Tokyo but was totally different weather up on the mountain. When we arrived somewhere near the mountain, we had no idea where we were, but it was a clear day and the mountain stood up really high so we kept on walking towards the mountain. When we finally reached to the bottom of the mountain, it was dark. Me and my other friend were really cheap so we bought flashlight from a HYAKU YEN (dollar store) shop. The other guy apparently invested about 20000 yen just to climb the mountain so he had all professional gears with a professional flashlight. Another mistake was that we took a wrong path where no one hiked on that path. We couldn't see a single point of light when we turned our flashlights off. Another surprise was that our flashlight battery went dead after two or three hours. So we had to rely on the professional guy to lead us the way and had to climb in a straight line following right behind him. However when we got to the top, it was worth having a disaster time because the sight was unbelievable.



Another experience that I should mention is a trip to onsen with our group members. We reserved a Japanese style hotel and spent a night there. It was my first time to experience a Japanese style hotel and was very excited about wearing Ukata. My onsen experience there was great. It was also my first time to experience an outdoor onsen with rain.

These experiences are something that cannot be seen in Canada. The picture below is a picture of our group members at the hotel. Japan has a custom of placing higher position colleague at the center of the table. As you can see, I was sitting at the end because I was the lowest level out of everyone in the picture.



Another great experience that I had in Japan was Halloween. My Japanese language class was volunteering to organize an event for kids on Halloween. I handed out candies to kids and had lots of fun.



During the new years' long holiday, I had a chance to visit Osaka to see my friend. I had lots of fun there too. I met my friend's Japanese friend and she invited us to her house. I've never seen a living style of a Japanese family. They offered a very nice dinner for my friend and me. It was sushi that I love, with beer. The father of the family was also a former worker from NTT so we had few talks. The kid in the picture below is three years old and spoke better Japanese than me. Two sisters in the picture are very friendly and one of them spoke English and Korean very well. She would speak few Korean sentences to us and we would reply back with Korean.



To recommend to other students about CJCP, I would have to say it is a one-time experience during your college life and something that will benefit so much in your life and your career. I had so much fun and I was very fortunate to get a job that I wanted. If you look for a different experience in your career and college life, I strongly recommend trying for CJCP because they will help you from getting a job and departing from Canada to going back to Canada. However for students who wish to make most out of it should learn Japanese before coming to Japan. It'll be so much easier if you knew at least few Japanese words.

My overall impression in Japan is that they have a very good combination of the latest technologies with preserving their history and culture. The memories that I will be bringing back home are my new friends that I made here in Japan. Also Japanese culture that I experienced during my stay is something that I could never forget. I will also miss foods here in Japan. Food here is something that I really enjoyed.