DeMaMech

Exchange Student Report

2005 - 2006

Joseph Dembler

Table of Contents

1. Personal Data

Name: Joseph Dembler

Email: j.dembler@gmx.de

Home Institute:

Technical University of Berlin
Faculty of Mechanical Engineering and Transport Systems
Institute of Engineering Design and Methodology
Strasse des 17. Juni 135
10623 Berlin
Germany

Supervisor: Prof. Dr. eng Lucienne Blessing

Host Institute:

Hokkaido University
Graduate School of Information Science and Technology
Laboratory for Digital Systems and Environments (DSE)
Kita 14, Nishi 3, Kita-ku Sapporo 060-0814
Japan

Supervisor: Prof. Dr. eng Masahiko Onosato

2. Executive Summary

Before I went to Japan for five months I was afraid that this might be a long time to stay in a country which I knew mostly only rumours of. After coming back to Germany I felt that these five months abroad where clearly too short and it would have been better to choose the ten months period.

That describes best what I feel about my student exchange and I can recommend this experience to everybody who is willing to study abroad.

The laboratory which I participated in was the lab for Digital Systems and Environments of the Hokkaido University. One of the far goals of the Lab's research is to create a functional digital mock-up of complete real world environments. My research was about rescue robotics and the need for better controllers in that field. The research schedule was tight and the requirements where challenging for me. This was mostly due to the lack of programming know how which is disregarded at my home university. In the end I was satisfied with my achievements and I will keep an eye on that topic since I became curious about the coming development in that field.

It was an interesting experience to see the different style of communication, community, studying and everyday life in Japan. In the beginning everything felt very different and the fact that I was an illiterate made things complicated. Everybody who ever saw a Japanese form will understand what I mean. After becoming familiar with my new situation everything changed. I started to recognize the similarities and real differences between the cultures.

Finally I would like to say that it were the people that made this exchange such a great time and wherever they came from it was fun to get along with them. I tried to learn some Japanese but the time was too short to overcome the phase of talking in pre learned phrases. Unfortunately I wasn't able to see some important parts and cities of Japan which I will make up for in the future.

3. Travel Schedule

Europe to Japan:

15th to 16th of March 2006

Berlin – London	British Airways
London – Hong Kong	Cathay Pacific
Hong Kong – Sapporo	Cathay Pacific

Japan to Europe:

16th to 17th of August 2006

Sapporo – Hong Kong	Cathay Pacific
Hong Kong – London	Cathay Pacific
London – Berlin	British Airways

4. Technical Report

Today's rescue robots are small exploration vehicles equipped with various types of sensors. Their main task is to deliver information about the environment which they are exploring in Urban Search and Rescue missions (USAR). Rescue robots should identify victims in disaster areas and find safe paths for human rescue teams to rescue victims. They are not able to perform the rescue of a victim themselves. In the current state of development the robots are mostly custom made or modified commercial platforms. The technical equipment of the robot depends on its field of application.

Figure 1: Rescue Robot of the Fire and Disaster Management Agency of Sapporo

The whole rescue robot research is still at an early phase and major problems are to be solved in the future. These problems are, for instance, the lack immersive controllers, delayed response to user input, the way data is transferred between robot and controller, the mechanical and electrical robustness and the lack of standards in all domains.

Figure 2: Phantom Omni Haptic Device

The goal of my research was to create a better control device for rescue robots, which was supposed to be universal and using the advantages of haptics. The used device was the six degree of freedom force feedback controller Phantom Omni by Sensable. The advantages of haptics were used to create a better immersion into the situation of the robot and to ease the control. This should prevent the operator of

the robot from making mistakes and therefore shorten the time that is needed to find victims.

USARSim is a rescue robot simulator that is used by the simulation league of the international Robocup Rescue challenge. It is today's most promising rescue robot simulator and has become a standard in the research community. Because of its ability to provide a high fidelity simulation environment and its expandability it was used in my research. The simulator is based on the computer game Unreal Tournament 2004 by epic games which provides decent graphics and physics calculations.

My task was to develop a client application that allows controlling either real rescue robots or simulated robots via the Phantom Omni. Since there is no standard for the communication between a rescue robot and the controller device the USARSim protocol Gamebots was used to control virtual and hardware robots. To translate the Gamebots protocol into the proprietary protocol of a hardware robot a server application was needed that directly control the robot.

The client application that has been developed in this research is called Interface. It provides the user with all necessary elements to control all programs that are needed for a simulation session and it is able to control hardware robots via the Server application. The graphical user interface of the client application provides the operator with the robot's video display and visualizes the current battery status. It is also able to show the data of a laser rangefinder, if the robot is equipped with such a device. The handling is the same for the control of either a virtual or a hardware robot.

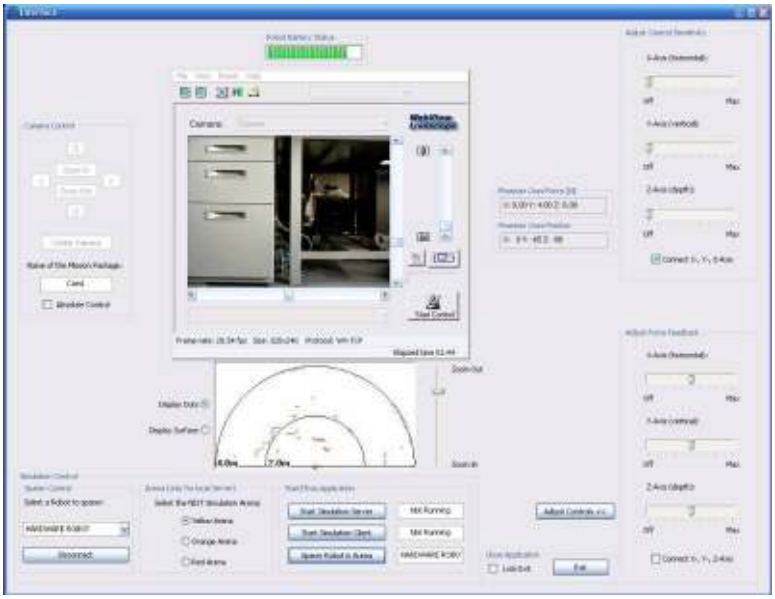

Figure 3: The Interface Program

The Interface and Server application work with Microsoft Windows and are implemented in C++ using the Microsoft Foundation Classes (MFC). Both applications are multi threaded to benefit from multi core processors and increase the robustness. Unicode is used to make sure that a localized Japanese version can be made.

The secondary task in this research was to build a simple rescue robot platform based on a Nihon SGI Blackship robot chassis. The Server application has been developed to control this specific robot type. The developed robot platform features

an http-camera for video pictures, a scanning laser rangefinder and a wheeled chassis for locomotion.

The Interface application provides the operator with the force feedback that should improve the immersion via the Phantom Omni. The used algorithm to generate the force feedback is simple and gives the operator the possibility to experience the current state of the robot's locomotion with their tactile percipience. The generated feedback force is calculated based on the overall speed of the robot and the gap between the actual speed of the robot and the desired speed. Therefore the operator is able to perceive possible problems during the locomotion process and react very fast.

Figure 4: The Rescue Robot Testing Platform

5. Exchange Student Life

Life as an exchange student in Japan is different from Europe. The differences start in the dormitory for foreign students, which wasn't exactly what most people expected. The building was old the rooms where small but sufficient. I spent only the nights in my room therefore I didn't miss anything. But the bathrooms were a problem. Three showers for 50 people are simply not enough and the condition of the bathrooms was terrible. The shower was extremely dirty and mould was growing everywhere. During the night time there was no heating available and also no warm water. This was annoying.

The next difference is the life in the lab. Many students are in the lab all day and often times even at night. The university buildings are open 24 hours a day so you can study whenever you want. The members of a lab share a strong community and there seems to be almost no contact with members of other labs. Groups are closed you are either in or out. People are friendly and when asked for help they always give their best to support you. This can lead into funny misunderstandings, because communication can be a problem from time to time. English is sometimes a source for the misunderstandings but also the friendliness of the people. Nobody will answer a question with "no" even if that is what he or she wants to tell you. That makes sometimes a little bit difficult to get critical feedback. On the other hand it is very convenient to live such a friendly environment and I enjoyed it. Some of my lab members refused to speak English, so I couldn't have any personal contact with them. Others were really open-minded and we had fun times to exchange our experiences.

We had several lab parties in those five months and they were always great. Everybody had fun and the atmosphere was really inviting. The first time that I felt as a part of my lab was after the first party. The parties always have an official part which is usually a dinner and after that comes the "second party". This usually means to do some activity like bowling or going to a bar together. The unofficial part starts normally with the "third party" where people go to another bar or to a karaoke place and have a lot more drinks together. After the end of the party the party is really over. The next day everything is normal again and nobody talks about what happened.

I did some language courses in the beginning but I had to skip them after several weeks because my research took too much time. My Japanese never reached a decent level I was only able to have some really simple conversations. In the weekends I usually went out with many other people (mostly also foreign students) to our favourite places. These were in Susukino which is the entertainment quarter of Sapporo. We had our favourite clubs, bars, karaoke places and of course our favourite sushi place. Going out in Japan is surprisingly cheap because of nomihodai. That means something like all you can drink. Almost every bar and club offers nomihodai. Also the restaurants are really cheap compared to Europe. We used that opportunity to go to a restaurant whenever we could and enjoyed the outstanding Japanese food.

Like the Japanese students I spent most of the time in the lab to do research, surf the internet and talk to other lab members. But I never slept in the lab like many of the Japanese students.

After the winter was over I started play soccer with many other foreign and Japanese students. This was always fun and sometimes we went for dinner together afterwards. I also did some biking trips to the sea or on mount Moiwa. Sapporo isn't a huge city like Tokyo and also not so crowded. That makes living easier. Another topic is the climate. The winter is cold with lots of snow the spring is cold with lots of rain. The early summer is quite cold with lots of rain and when the heat comes the weather is really humid. Periods with simply nice weather doesn't seem to exist. Maybe fall is a nice season but I wasn't in Japan during fall.

I did two trips during my exchange time. One was to a small island northwest of Hokkaido. That was during the golden week in early may and the only opportunity for me to see the countryside of Japan. The second trip was to Tokyo with some of the lab members. That was really interesting because Tokyo is such an exiting city. I enjoyed every minute there and we could stay in a Japanese style hotel for the first night. Unfortunately I couldn't visit other parts of Japan but this was for sure not my last trip to Japan.

6. Summary

I stayed five months in Sapporo to participate in the DeMaMech exchange program. My research was about rescue robotics and how to facilitate their control. I finished my project in time and it will be accepted at my home university as a study thesis which is a mandatory thesis that I have to submit. The time in Japan was great and therefore too short of course. I discovered many differences between Europe and Japan and I see the strengths of both systems a lot clearer now. It is not only a good experience to live in a different world it also gives a better view of the own world through a different perspective. If I would have the chance to do it again I wouldn't to hesitate to do it.