

A short summary of my time at University of Virginia, VA, USA

05.30 on June 28th 2006 a very tired family consisting of Marcus, Ulrika, Rebecca and Alexander Brohede were done with the check in at the Landvetter airport. An approximately 12 hour long flight (including stops) to the big country in the west was about to get started. Once the plane was in the air, taking us towards London and then onwards to Washington DC my wife and I laughed and told ourselves that we were crazy to take to small children across the earth for a four month long stay. We had found a place to stay at on the Internet and the landlords would meet us at the airport. They had promised to sell us their old car, a Toyota mini van. Our only means to contact them was a cell phone number and if they did not show up we would be stuck at Dulles International Airport with two kids, 5 and 3 years old. Maybe it was not so strange after all to be nervous.

After the long flight with absolutely no problems at all we finally arrived to the US. Gary Pennet (the landlord) met us at the airport and he and his wife to great care of us. He bought us Pizza and told us all about the practical stuff we needed to know about the car we bought and the townhouse we were renting. It turned out that we really struck gold concerning accommodations and car purchase. The Pennets were very friendly and helpful throughout our entire stay in the US, for example, Susan Pennet bought a booster seat for Alexander, our youngest son, to use.



Pizza at the Pennets

The accommodation in Charlottesville was excellent. We had, for example, access to a swimming pool and Ulrika, Rebecca and Alexander went there almost every day. I tried to use the pool when I got back from work. The kids, who did not know any English, got friends quickly. We got especially close to one family, the Smiths. We will keep in touch with the Smiths long after this trip. It feels like a life long friendship. Rebecca can still ask us if we can go to see Ezri and Kira, the two Smith girls.



Alexander & Rebecca playing and swimming.

I shared office with Leo Selavo, a post doc from Lithuania, during my four month stay at the University of Virginia. Leo, Jim (a PhD student from China), Gilles (a post doc from France) and I spent a lot of time together both at the office and socially. We discussed different research projects and research questions and I tried to participate in theory lunches when ever I could. On weekends and after office hours we met and did sports activities together.



Beach volleyball with some friends from UVA.

The project I carried out was to use my database architecture to connect MICAz motes and real-time simulations. The principal idea was to take sensor readings from one sensor that measured oxygen level and pulse. All readings should be stored in the distributed database and the simulator should read from the database. The results from the simulations should then also be stored into the database. Finally, this result should be propagated by the database's replication protocol to another MICAz mote that would give a nurse feedback on the patients situation and any potential future risks as indicated by the simulation.



My office at University of Virginia & a MICAz mote.

To evaluate our design we have implemented part of it as a proof of concept. The key features of our design is present in this implementation, i.e., we show the ability to sense the environment and to react based on the sensed data and simulated results based on the sensors. First we have collected vital signs (heart rate and blood oxygen level) data from volunteer persons. We then use this data in a replay fashion to achieve a scenario where the data represents a patient under examination without any risk to any real patients and with the ability to reproduce the scenario any number of times. Under normal operation the simulation application reads the sensor values that reside in the database every 10 seconds. Should something out of the ordinary occur, for example a spike in the heart rate or if the blood oxygen level suddenly begins to drop, the frequency of read readings will double to allow for a more fine grained data collection that the simulation application then uses as input. Should the patient's condition continue to decline the read frequency will increase until the maximum sample frequency has been reached.

A fixed time after a detected change in the vital signs pattern the simulation application will produce a suggestion on how to change the treatment of the patient. A nurse (or doctor) then can use this suggestion on how to continue to treat the patient and will get an improved situation knowledge to base such decision on. The suggestion in this simplified proof of concept would be of three different types, increase, remain, or decrease the amount of IV feed to the patient. If the suggestion is to increase or to decrease a suggested amount will also be presented.

The suggestion is displayed on a SeeMote, which is a special peripheral equipment that can be put on a MICAz mote. The SeeMote has a small LCD that can display the best and the second best course of action (as calculated by the simulation). As an extra feature a buzzer on a sensor board connected to a mote nearby the patient sounds an alarm if the pulse drops below 50 or if the oxygen level drops below 90. This will help to attract the attention of any nurses in the vicinity of the patient.

I did not have enough time to finish the project on site in US, and I am still working on the final part of the implementation. I did all the critical work at UVA and have good contact with key people should I run into problems with the implementation. The

outcome of my work is intended for a conference paper, preferably in the wireless sensor network community or the information fusion community.

The opportunity to see another research environment I value highly. To be able to spend four months in rather large research group (approximately 20 PhD, 2 Post Doc and 2 Professors) has made an impression on me and I am confident that my continued PhD studies will benefit from this experience. In the specific project that I carried out during my time at the University of Virginia I was able to collect sensor reading that I later on can use as input to one of my simulations. Something that I hope will be a substantial part of my thesis. The possibility to work with sensors and the programming of sensors I find invaluable and I also see the potential for future projects, some of which I am already working towards.



The building where I worked.

Finally, I would like to thank my sponsors for making this trip possible. I have as a researcher been able to broaden my network of contacts and gained a deeper knowledge in one of my primary subjects for my thesis. Furthermore, my family and I have had an experience of a lifetime in the US and we cannot wait to go back.

/Marcus Brohede