Researcher's Corner

Dedicated to faculty members at UOWD, the Researcher's Corner highlights the career and profile of Academics who have produced outstanding work in the field of Research. In this issue, we look at the research journey of Dr Mohamed Watfa and Dr Peter Hosie, recipients of the Research Excellence Award 2009

Dr Mohamed Watfa

Current Position:
Assistant Professor, Faculty of Computer Science and Engineering, UOWD

Research Accomplishments:
Over 40 research publications ranging from books, book chapters, journals and papers in international conference proceedings.

Qualifications:
BSc American University of Beirut, MSc University of Toledo, Ohio, PhD University of Okhlahoma in Norman, USA

Armed with a passion to teach, Dr Mohamed Watfa is not only an avid researcher but is also a young starter in his field. Having obtained his PhD at the age of 23, he was one of the youngest to graduate from his university and was also on the Dean's Honors list, receiving a number of prestigious awards and scholarships during his years. His latest book, 'Coverage Strategies in Wireless Sensor Networks' was launched in 2009. Dr Watfa has also served as guest editor for a number of international journals and has held a position of lead network engineer at different networking companies.

Here Dr Watfa talks about his work and recent projects.

My Research Philosophy
Naturally, having ideas and goals are only part of conducting research. In order to have the greatest effect, ideas should address a current or future need and have the funding, manpower, and facilities to be fully explored. There is currently a lot of excitement and research activity surrounding pervasive computing and autonomic computing. Because of the obvious benefit to long term scientific progress, work in large-scale self-adapting, self-healing, and self-managing systems has been my research focus since joining the UOWD. In particularly, I have been involved with wireless sensor networks, a new class of distributed systems composed of distributed sensors, actuators, computation, and wireless communication. The vision of many researchers is to create sensor-rich 'smart environments' through large-scale deployment of such nodes in the environment. Each node combines a miniaturized but otherwise traditional computer (e.g., capable of processing, storing, and communicating) with sensors that can detect the state of the environment. Sensors might detect temperature, sound, light, the presence of objects, people, or chemicals. There are a wide range of applications envisioned for such sensor networks, including microclimate studies, groundwater contaminant monitoring, precision agriculture, condition-based maintenance of machinery in complex environments, urban disaster prevention and response, and military interests. In many ways Sensor networks are a new class of distributed systems.

My Research Outcomes:
Though existing systems such as the Internet have successfully tackled many scaling problems, sensor networks break several key assumptions that hold true in the Internet. These new assumptions have led to a flurry of new systems research, in which I have taken part. The potential for this research area has been demonstrated by the increased number of industrial, university and research institutions working on this area, and by several commercial and scientific applications that have been deployed. My primary research focus lies in the broad areas of wireless networking including performance analysis, algorithms, protocols and optimization of wireless sensor networks. I have been working on how to understand these sensor networks and how to make them more energy efficient through theoretical analysis and experimental studies. During the course of my research, I had the opportunity to collaborate with many excellent researchers and mentors which was a very valuable experience.

My Research Experience
Has taught me a number of important lessons and illustrated several interesting features of the wireless sensor network research issues. An important milestone which is highlighted is that the community is now building real sensor systems, not just theorizing about and simulating them. Research topics that grow out of implementation problem solving have the advantage of being grounded in reality. It's important for me to remain grounded by never giving up the real implementations. Simulation and theory are important and serve crucial roles, but not to the exclusion of the real world. In my future work, regardless of the specific topic, I will always want to have the appropriate facilities for testing and verifying theory against reality. A general goal of mine is to construct sensor network test beds, available to everyone from students to outside researchers, allowing ideas and code to be tested in the real world.

"A general goal of mine is to construct sensor network test beds, available to everyone from students to outside researchers, allowing ideas and code to be tested in the real world"

My Research Projects

Data Mining in Smart Sensor Networks: Sensors streaming their data online are turning the Internet into a global sensor network. Software platforms that integrate and mine these data streams may create a world in which sensors become pixels, where we can browse reality as easily as we browse Web pages today. The evolution of low cost, networked sensors, often directly Internet-enabled, is bringing sensors out of their traditional closed-loop realms into the rest of our reality. Consider cell phones: There are 1.4 billion active cell phones in use today with more than half a billion units sold last year. As cameras become a standard cell phone feature, we have become the most connected and instrumented people in history. As sensor and communications technology continues to develop, we can envision a very different Internet than the one we use today. Rather than sending messages and browsing Web pages, we may experience new interactions such as experience sharing and browsing reality.

Security in wireless sensor networks: Today, many networking and distributed systems are very vulnerable to faults or attacks, which can compromise the system performance, corrupt important data, or expose private information. In my research, I will investigate security issues in networks and distributed systems, such as the resilience of peer-to-peer systems, the defense to distributed denial-of-service attacks, and privacy-preserving data mining.

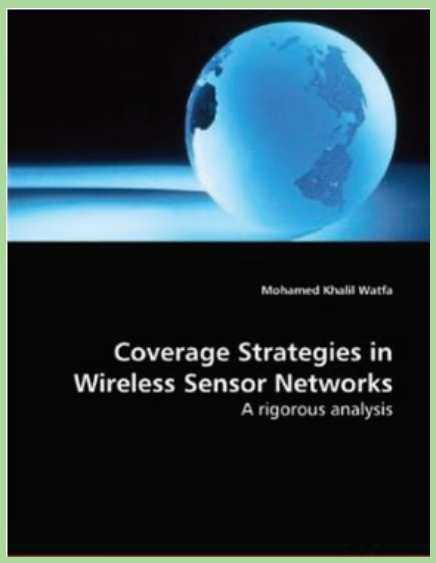
Next generation ubiquitous and pervasive healthcare systems: Although still in its infancy, the sensor network technology holds great potential for a significant impact on next generation ubiquitous and pervasive health care. Today, hospitalized patients are tethered to instrumentation, even though some attention has been given to highly customized, high-cost wireless devices. Instances of un-tethered, wireless devices have been few in number, but advances in bioengineering, biochemistry and biotechnology hold the promise of an ever-expanding pool of knowledge in this emerging discipline.

My Future Research Goals

An important aspect in my future research position at UOWD is the collaboration with users that need these systems. I am fully motivated to collaborate with researchers in a leading institution such as UOWD, which I believe is extremely important for me to broaden my horizon, solve research problems of practical value, and contribute to cutting-edge technology. I am very fortunate to be at UOWD where a large number of the faculty members engage in cutting edge research projects and are always willing to collaborate on large research projects. Finally, I believe that important research work should also be successful in attracting research funding. As such, I will be actively seeking research funding from various sources to support my research. The UAE provides us with many research opportunities such as the National Research Foundation and the Emirates Foundation and we should take every opportunity that comes knocking on our doors.

For more updated information on Dr. Watfa , please visit his website:
http://mohamedwatfa.synthasite.com/

> "I am fully motivated to collaborate with researchers in a leading institution such as UOWD, which I believe is extremely important for me to broaden my horizon, solve research problems of practical value, and contribute to cutting-edge technology"



My recent book which is a result of five years of research and a direct result of my PhD dissertation deals with three dimensional coverage and connectivity in sensor networks. Sensor networks are a new class of distributed systems composed of distributed sensors, actuators, computation, and wireless communication. One of several applications of the results of this book is intelligent transportation systems and an important goal in transportation systems is to reduce the dramatically high number of accidents and their often fatal consequences especially in Dubai. To reach this goal, a good approach in modeling the communications in the highway would be considering it as an ad-hoc wireless network with the mobile cars as mobile nodes that are dynamically connected to static wireless sensor networks deployed on the roads. The information gathered by such sensors can be used to prevent accidents using a wireless sensor network deployed on the highways or determine the severity of accidents after they happen. According to the World Health Organization, about 3000 people die in crashes each day worldwide and the financial cost of these crashes is more than 230 Billion dollars. These accidents could be due to the fault of the driver, the other driver, or due to careless driving. The main causes for car accidents are irresponsible behavior and a lack of respect for the traffic regulations. Using some of my proposed algorithms, some of these fatal accidents can be minimized.