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Hybrid navigation system for minimally invasive surgery-Phase I: offline sensors calibration

Minimally invasive surgery (MIS) is not currently widely used by surgeons due to its cost and complex training requirement of surgeons. As a first step towards making MIS a more accessible technology to use is to provide the surgeon with quality images inside the patient as well as the surgical tool location automatically in real time in a common reference frame. Then provide real time suggestions of how to navigate inside the human body in order to follow the pre-operation (pre-op) path. The objective of this paper is to build a platform to accomplish this goal. A set of three heterogeneous asynchronous sensors is proposed to help the surgeon navigate surgical tools inside the human body. The proposed system consists of a laser range scanner (LRS) to emulate the CT/MRI whose image is used to generate the pre-op path by the surgeons, an electromagnetic tracking system (EMTS) that provides three dimensional position and orientation of the surgical tool inside the human body, and a small size camera attached to the EMTS to provide real time images. This set of sensors provides all the necessary information needed for MIS navigation. The sensors have different data rate, different reference frames, and independent clocks. A prerequisite for successful navigation is to represent all the sensors data in a common reference frame. The focus of this paper is on off line calibration of the three sensors, i.e. before the surgical device is inserted in the human body. This is a pre-requisite for real time navigation inside the human body. The proposed off line calibration technique was tested using experimental laboratory data. The accuracy of the calibration process was promising with an average error of 0.1081 mm and 0.0872 mm along the x and y directions, respectively, in the 2D camera image.

Biography

Ali T Alouani works as a Professor in Department of Electrical and Computer Engineering at the Tennessee Technological University. He completed his Ph.D. in Electrical Engineering from the University of Tennessee Knoxville in the year 1986.Dr. Alouani developed and taught many undergraduate and graduate courses in the Systems and Signals areas. To date, he has published 120 technical journal and conference papers. He holds 4 patents. He has been active in many areas of Electrical & Computer Engineering. His theoretical research includes Stochastic Systems, Sensor Data Fusion, Artificial Neural Networks and Fuzzy Systems, Robust Control, Power Systems Stability & Control, Independent Component Analysis.

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5G The Next Frontier in Wireless Communications

5G is much more than just evolution of the mobile technology. It will empower new functionalities for people, society and enterprise. 5G is expected to provide fibre like data rate with massive system capacity, and ultra-reliable and extreme real-time communications. These are vital in the advancements of many new applications including the Internet-of-Things, driverless cars, virtual reality, tactile internet and more. In this talk, I will provide an overview of 5G vision and performance targets followed by some key enabling technologies and examples of the research work at the University of Sussex.

Biography

Falah Ali is currently a Reader in Digital Communications at the University of Sussex. He leads the Communications Research Group in the Department of Engineering and Design. He received his PhD from the University of Warwick, and his MSc and BSc from Cardiff University, in the UK. He also held a postdoctoral position at Lancaster University focused on advanced multiple access techniques for wireless communications. He published over 100 papers in reputable journals and conferences and has served as a chair and member of technical programme committees in several conferences. His research interests are in 5G wireless communications systems. He is a Fellow of IET, a Senior member of IEEE, and a Chartered Engineer.

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Future Robotics and Automation for the Third Millennium

The future research, innovation and development in the field of automation and robotics in conjunction with the ubiquitous access to internet, information communications technologies (ICT), smart computational devices (SCD) and ultrafast global communication were discussed. The third millennium is a new era of the smart cyberspace that is becoming pervasive in its nature while connecting the next generation of ultra-smart robotic devices with the computationally powerful SCDs accessible to anyone, anywhere and at any time. In support of automation and robotics, the telecommunications network providers and SCDs developers, are working together to create much faster transmission channels with provision of higher quality of service for any multimedia content for anyone, anywhere at any time. The human machine interface with high definition audio and video facilitates seamless control of smart robotics and computational devices (SRCD), which are becoming a common technology in family homes, business, academic, and business, and industry worldwide. Today, SRCD are communicating via robotic internet and may be accessible to public and private customers, while storing important and to some extend confidential information in their memory. In case that SRCD may be lost, stolen or hacked into, the information stored in the memory could be abused, compromised or used for malicious purposes. In near coming future we may see the SRDC be used to aid, or to protect family residential areas, private homes, schools, hospitals, manufacturing plants, as well as cyber physical critical infrastructures (CPCI) such as, atomic power and chemical plants, and large cities. The further research, innovation and development of future ultra-SRCD side by side with future ultrafast robotic internet, will require even more research, innovation and development in the field of cyber assurance and security. Proper safety and security mechanisms and policies will become critical to protect the SRCD and COIP from any form of intrusion or cyber threats from anyone, from anywhere at any time. The author discusses the current and future trends of research, innovation and developments in SRCD, CPCI and cyber assurance, in conjunction with the future ultra-fast internet and ultra-SRCD. The author promotes creation of multidisciplinary multinational research teams and development of next generation SRCD and fully automated environment while utilizing ultra-smart robotic and computational devices, in conjunction with the critical cyber safety and assurance challenges for today and for tomorrow.

Biography

Eduard Babulak is an accomplished International Scholar, Researcher, Consultant, Educator, Professional Engineer and Polyglot, with more than 30 years of experience. He successfully published and his research was cited by scholars all over the world. He serves as Chair of the IEEE Vancouver Ethics, Professional and Conference Committee. He was Invited Speaker at the University of Cambridge, MIT, Yokohama National University and University of Electro Communications in Tokyo, Japan, Shanghai Jiao Tong University etc. His academic and engineering work was recognized internationally by the Engineering Council in UK, the European Federation of Engineers and credited by the Ontario Society of Professional Engineers and APEG in British Columbia in Canada. He speaks 16 languages and his biography was cited in the Cambridge Blue Book, Cambridge Index of Biographies, Stanford Who's Who, and number of issues of Who's Who in the World and America. He also served as Fellow of the Royal Society RSA, London, UK; Chartered Professional IT Fellow, Mentor and Elite Group Member of British Computer Society, London, UK; Invited Panel Member for National Science Foundation Graduate Research Fellowship Program, USA; Expert Consultant for CORDIS FP6 - FP7 European Commission, Brussels, Belgium; Mentor and Senior Member of the IEEE and ACM, USA; Nominated Fellow of the Institution of Engineering and Technology, London, UK. He is also Professional Member of American Society for Engineering Education, American Mathematical Association, and Mathematical Society of America, USA.

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Artificial immune system based approach to cyber-attack detection

Cyber attacks have been increaing at an alarming rate. For example, the attack on Dyn company on October, 2016 have resulted in the cutoff of internet services in the North East of the USA. The Dyn company is an organization that controls many of the domain name servers that give service American domains. This widely successful attack utilized the infamous Mirai – a nasty piece of malware that powers an extensive botnet largely populated by internet of things (IoT) devices. Advancements in internet of things (IoT), wireless, advanced robotics, intelligent agents, cloud computing and other technologies, as well as reliance on 3rd party commercial off-the-shelf software will also increase the cyber-attack surface in systems and networks. Like the ability of the human immune system to detect all infections and how the human body can be related to the complex network of interconnected systems that exist today, our proposal takes a biological approach to solving the network intrusion detection problem. Our proposed bio-inspired system for network intrusion detection makes use of the models that exist in immunology which has been abstracted to an area under artificial intelligence known as artificial immune system (AIS). The proposed system will be a combination of the immunology-developed theory of self-nonself (SNS) and danger theory (DT). The proposed system stems from our successful application of SNS and DT respectively to the detection of cyber attacks that originate from external networks. Our proposed system will be detecting cyber-attacks that originate from both inside and outside of a communication network.

Biography

Tarek Saadawi is a Professor and Director of the Center of Information Networking and Telecommunications, City University of New York, City College (CUNY/CCNY). He received his BSc and MSc degrees from Cairo University Egypt in 1973 and 1975 respectively and the PhD from the University of Maryland, College Park in 1980. He is Co-Editor of the book "Cyber Infrastructure Protection," Strategic Study Institute, volume 1, May 2011, and Volume 2, August 2013, and Co-Author of the book, "Fundamentals of Telecommunication Network". His current research interests are intrusion detection systems and cyber security.

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Pasi Hurri
President & CEO of BaseN Corporation

Intelligent Spimes - future of the digital fabric of reality

AI and IoT are changing the way in which organizations innovate and control their processes, products and services. Spimes build the perfect base for evolving AI applications which enable the transformation from physical products to services and further allow for easy mass customization.

Biography

Since establishing BaseN Corporation in 2001, Pasi Hurri has been holding the position of Chief Executive Officer. Mr. Hurri is an expert speaker and senior Member of IEEE as well as a visiting lecturer at several Universities. Prior to founding BaseN, Mr. Hurri spent more than a decade in senior technology management positions. He presided the engineering effort of the KPNQwest Eurorings network, then the largest pan-European carrier transporting more than 50% of the Internet traffic. Within Ahlstrom Corporation Mr. Hurri managed the creation of a global IP network in the early 90`s.

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Michaelene Holder-March

NHS & MHM Health Consultancy Ltd, UK

Internet of Things (IoT) Technologies Revolutionary Impact on Healthcare

Technology is swiftly changing the landscape of care and delivery frameworks whereby healthcare organisations can now help patients through the utilization of Internet of Things (IoT) technologies / systems to improve patients' health outcomes and experiences by using rich health data and insights to enable a holistic patient diagnosis. Globally healthcare organisations are unconsciously challenged to keep stride with patient behavior and expectations for digitally mobile and accessible systems of care.

Internet of Things (IoT) technologies has certainly revolutionized the management of patients. This healthcare environment has seen numerous (IoT) applications in healthcare from self-management devices, automated pharmacy dispensers, wearable devices (e.g. fitness trackers, sleep management) remote monitoring to smart sensors keep track of newborns (pediatric and maternity units) and medical device integration. Internet of Things (IoT) certainly has the prospect of keeping patients away from emergency rooms, wards and outpatients clinics whilst safeguarding clinical safety and doctor's treatment and care planning.

However in regards to the management of complex illnesses, Internet of Things (IoT) technologies has stimulated patients to be more active in monitoring their individual health which is of great benefit to the patient family, careers and wider population. The Internet of Things (IoT) Technologies wearable devices which may be worn as a wristband are available to track exercise, sleeping patterns and vital signs such as heart rate, pulse, respirations and blood pressure enabling patients to monitor their own progress or performance, and then transmit their health data back to their healthcare provider for treatment plan and review of care. This is handing patient the keys of "health ownership" and empowering patients to act and take full control of their health whilst healthcare practitioners can monitor conditions and administer appropriate treatment.

There are hurdles for healthcare organisations in regards to the deployment of Internet of Things (IoT) Technologies this includes the lack of interoperability with current patient record electronic system, suppliers accountability for failures, data storage, consent and data sharing, password protections and the management of the multiple connected devices from various suppliers. Other published hurdles are the tremendous quantity of hospital and multiple streams of patient data from various devices and readiness for the hospitals information technology departments to manage data security, compliance with information governance, data regulations and cyber security which are to be risk managed on a daily basis. Despite the hurdles the benefits of fully embracing Internet of Things (IoT) Technologies within healthcare is a welcome advancement in modern healthcare.

Biography

Michaelene Holder-March, is a goal driven healthcare executive with over 31 years of leadership and training experience. She is also well known and respected in the UK and USA for her professionalism, her vast experience and portfolio of managing Corporate & Clinical Governance, Information Governance, Risk Management, Operations, System Resilience, Claims, Audit and Health and Safety in both the public and private healthcare sector. Michaelene Gail Holder-March is a qualified teacher, nurse & midwife with registrations both in the UK & USA; she also holds a LLB and MBA in Management. She is a strong advocate of hands-on, inquiry based learning, and she actively involves herself in a variety of charitable community service, mentoring /coaching others to follow her lead.

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