

POLE OF RESEARCH EXCELLENCE

IN

REAL-TIME ENGINEERING FOR INDUSTRY 4.0

1. Introduction

Industry 4.0 is the subset of the fourth industrial revolution that concerns industry. However, the fourth industrial revolution encompasses areas which are not normally classified as just an industry, such as smart cities, for instance. Although the terms "industry 4.0" and "fourth industrial revolution" are often used interchangeably, "industry 4.0" factories have machines which are augmented with wireless connectivity and sensors, connected to a system that can visualise the entire production line and make decisions on its own. In essence, industry 4.0 is the trend towards automation and data exchange in manufacturing technologies and processes which include cyber-physical systems (CPS), ultra reliable and low latency pervasive communications with 5G, the internet of things (IoT), cloud computing, cognitive computing and artificial intelligence.

With the advent of high speed telecommunication systems such as, 4G/5G mobile systems, IEEE 802.11/WIMAX based wireless LANs, coupled with major breakthroughs in IoT, AI and cloud computing, several engineering applications can now be effectively carried out in real-time to significantly increase productivity. Apart from the classical real-time communication applications such as video conferencing, broadcasting, live streaming and telemedicine, several other engineering applications now require real-time infrastructures. Examples include process monitoring and control, utility management and optimization, transportation, self-driven cars, agriculture, weather forecasting etc. A new branch of engineering known as Real-time Engineering has therefore emerged which encompasses all the engineering technologies and systems that are enabling Industry 4.0 and are indispensable for the implementation of Industry 4.0.

The main aim of this research group is to develop and deploy real-time engineering technologies that are an integral part of Industry 4.0. Essentially two main objectives are targeted:

1. Conduct fundamental research in real-time communication systems, IoT, AI techniques, data security mechanisms, multi-criteria optimization, sensors, MEMs, Microcontrollers, FPGAs and other technologies which support real-time engineering applications.
2. Develop and deploy a wide spectrum of real-time engineering systems ranging from data transmission, tracking, process monitoring and control, data security, anomaly detection, utilities management, traffic and transportation, building automation, signaling, predictive maintenance, AI based optimization, robotics etc.

2. Main Research Thrusts

The group will have essentially three main research thrusts which are as follows:

A. Next generation Sensors and Microcontrollers

This research area will cover fundamental research on different sensor types such as nano-sensors, MEMs, smart sensors, satellite based sensor, FPGAs and microcontrollers. Figure 1 gives an overview of these aspects:

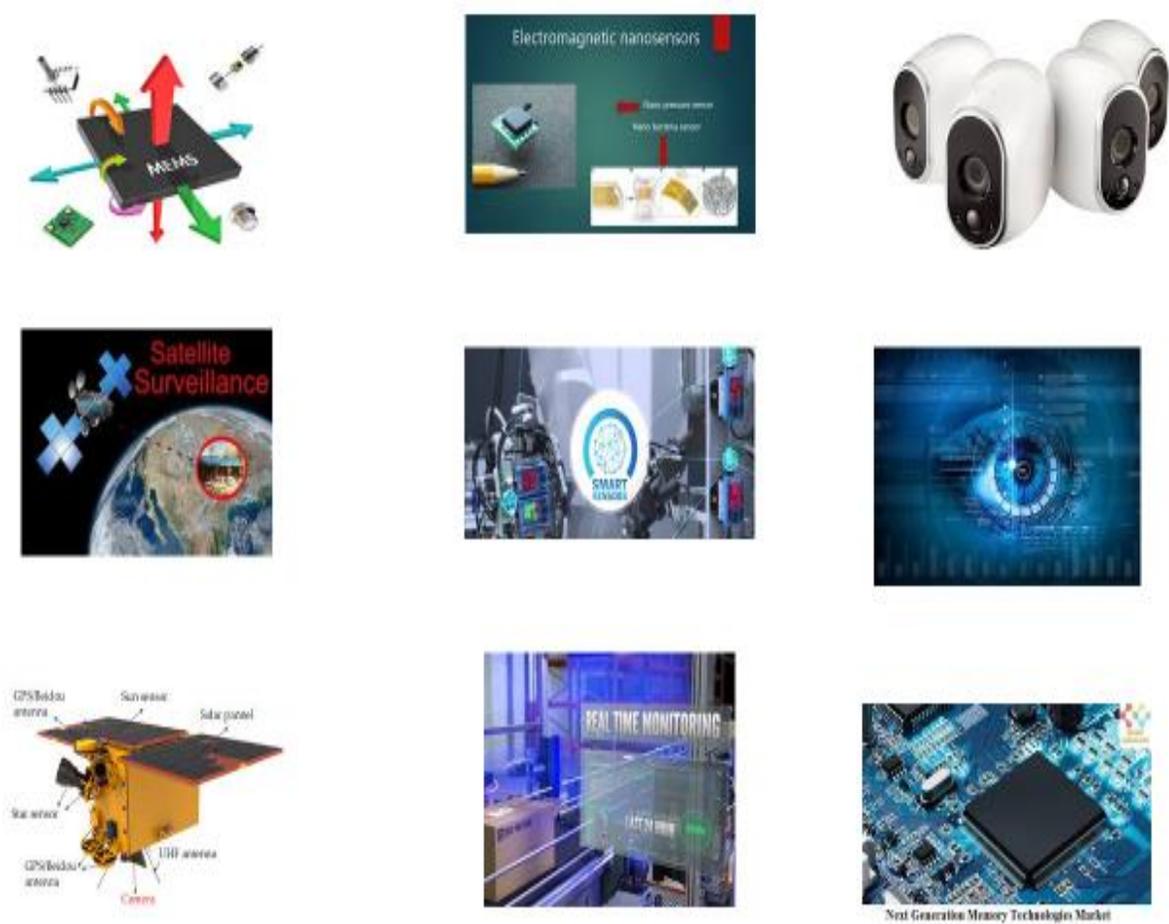


Figure 1: Research on sensors and microcontroller technologies.

B. Real time communication systems (5G, Wifi, WiMax)

This area of research will focus on the communication technologies that can support ultra-reliable and low latency transmission, enhanced mobile broadband connectivity, massive machine type communications, intelligent and unified connectivity as well as data security. Figure 2 summarises the main aspects of this research area.

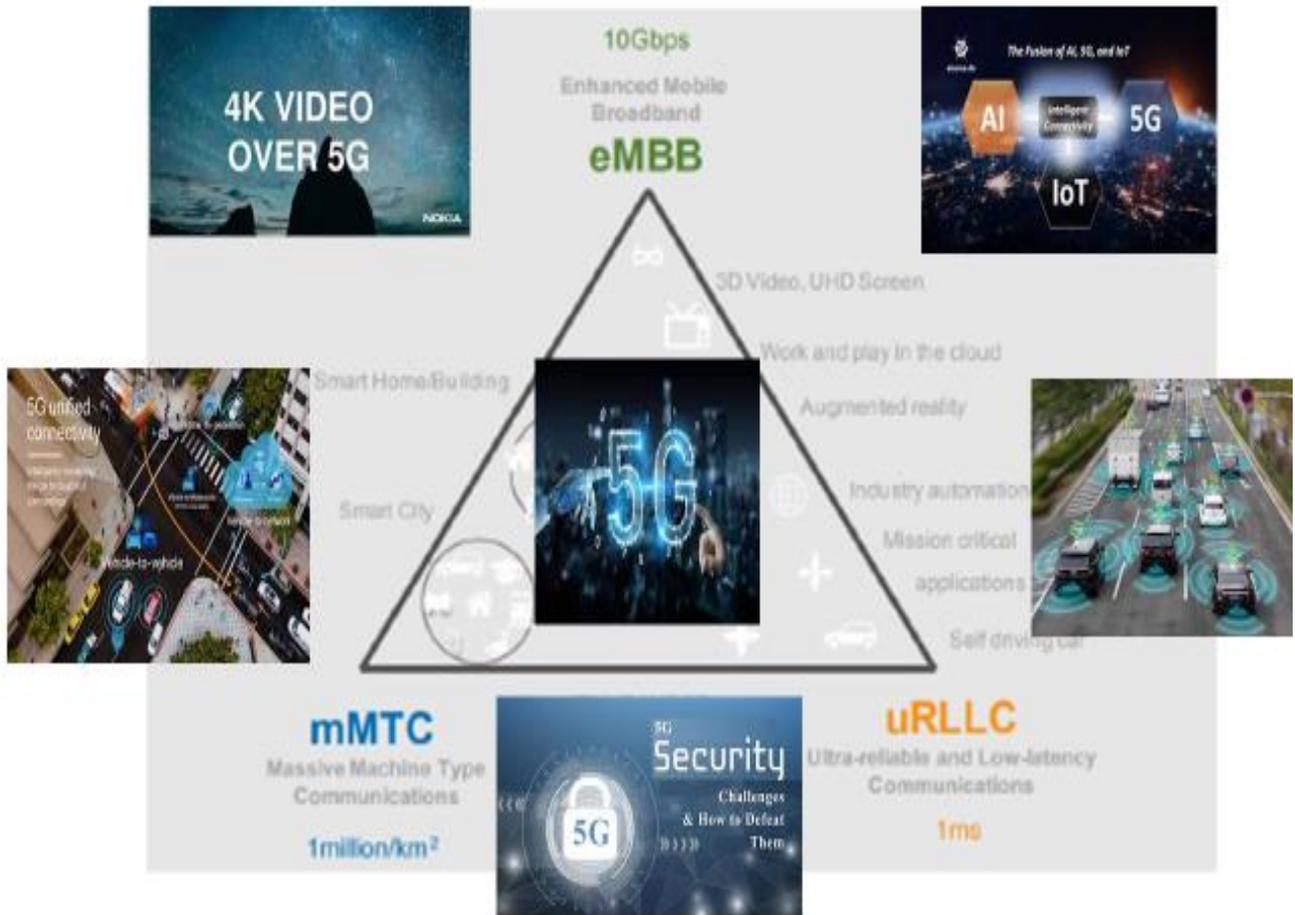


Figure 2: Real-time communications.

C. Real time analytics, AI and Computing

This area of research deals with the development of new AI techniques and analytics techniques that can be applied in various situations such as energy management, traffic control, bandwidth optimization etc. An overview of this area is given in Figure 3.

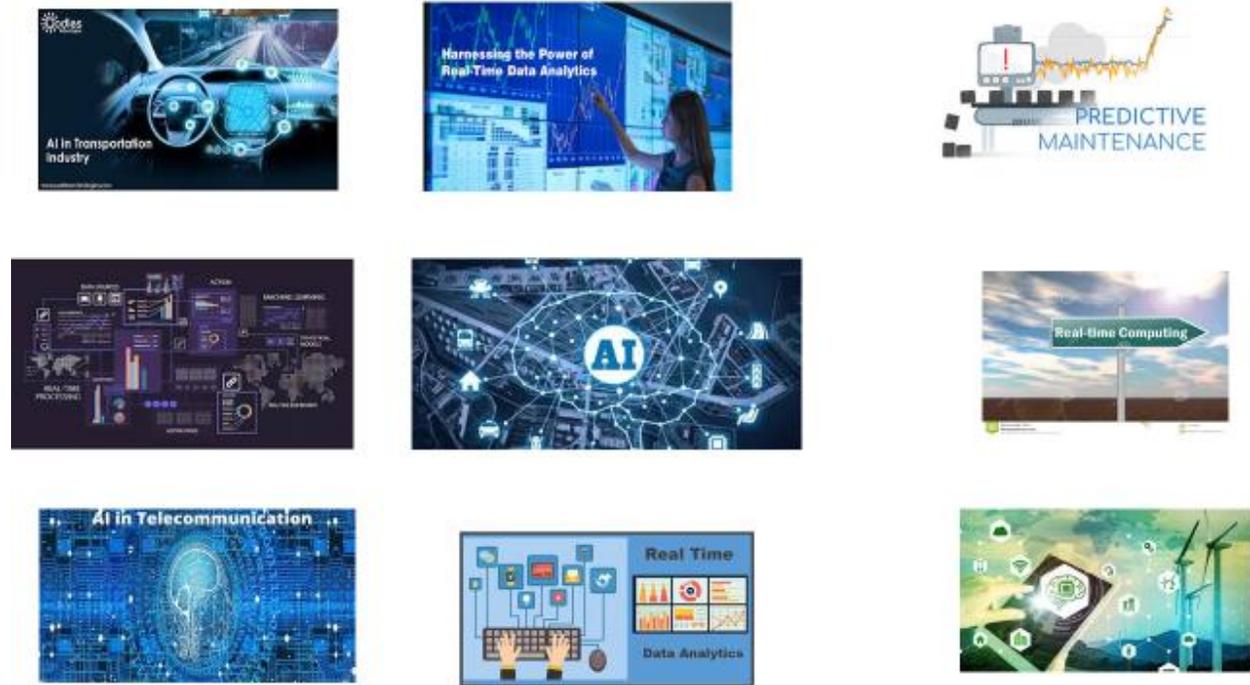


Figure 3: AI research and applications.

3. Brief profile of the group

Group Leader: Associate Professor (Dr) T.P. Fowdur, C.Eng, MITP, MIEE

Dr. T.P. Fowdur received his BEng (Hons) degree in Electronic and Communication Engineering with first class honours from the University of Mauritius in 2004. He was also the recipient of a Gold medal for having produced the best degree project at the Faculty of Engineering in 2004. In 2005 he obtained a full-time PhD scholarship from the Tertiary Education Commission of Mauritius and was awarded his PhD degree in Electrical and Electronic Engineering in 2010 by the University of Mauritius. He is also a Registered Chartered Engineer of the Engineering Council of the UK, member of the Institute of Telecommunications Professionals of the UK and the IEEE. He joined the University of Mauritius as an academic in June 2009 and is presently an Associate Professor at the Department of Electrical and Electronic Engineering of the University of Mauritius. His research interests include Mobile and Wireless Communications, Multimedia Communications, Networking and Security, Telecommunications Applications Development, Internet of Things and AI. He has published several papers in these areas and is actively involved in research supervision, reviewing of papers and also organizing international conferences.

Group members:

Dr. M. Gooroochurn, MIET, LEED AP BD+C

Dr. M. Gooroochurn is a Senior Lecturer in the Mechanical & Production Engineering Department of the University of Mauritius, and is an accredited professional in green building design and construction (LEED AP BD+C) with the United States Green Building Council. He has been the recipient of several awards, namely gold medal for best faculty of engineering graduate in 2003, DAAD best student award for his masters in Germany and the commonwealth scholarship for his doctorate studies at Loughborough University, UK. He has over three years industry experience as research manager and head of sustainability in building services consultancy and has been involved in UNDP projects at national level for developing an energy audit management framework for Mauritius and devising sustainability principles for local buildings. He has administered and led the certification of green buildings. He is a member of the Institution of Engineering and Technology (IET), UK, and has worked on several research projects for improving the thermal comfort and energy efficiency of buildings in a tropical context. He has specific research experience in machine learning, pattern recognition, sensor and instrumentation for gathering measurements in empirical studies and in carrying out building energy modelling and dynamic simulations for parametric analysis of building factors. He has recently been nominated the Ellen McArthur Circular Economy pioneer for Mauritius and he is willing to bring his contribution in furthering circular design and Industry 4.0 principles in making Mauritius a vibrant, entrepreneurial and sustainability-led economy.

Dr. M.A Hosany

Dr Mussawir Ahmad HOSANY (m.hosany@uom.ac.mu) received his B.Eng (Hons) degree in Electrical and Electronic Engineering with first class Honours from University of Mauritius in 1997, MSc degree in Electronics and Communications Engineering with distinction from University of Ulster (Belfast) in 2001 and PhD from University of Mauritius in Communication Theory in 2004. He has been awarded the University of Mauritius Postgraduate scholarship to read for his Mphil/PhD degree in 1998 and obtained the British Government Postgraduate scholarship by the Association of Commonwealth University in the year 2000. In 2009, he was awarded the USA Fulbright postdoctoral fellowship and proceeded to California. He worked on a 12-month research project at the San Diego State University and successfully designed and implemented a cross-layer approach for H.264/AVC over fading channels. He was appointed as Head of Department of Electrical and Electronic Engineering from 4th Oct. 2010 to 3rd Oct. 2012. Presently, he is appointed as senior lecturer at the University of Mauritius. He is a member of the IEEE and his current research interests are in channel coding and modulation, 5G wireless communications, coded MIMO systems. He has formed part of the Section Nomination Committee of the IEEE Region 8 to carry out the IEEE Mauritius Subsection Executive Committee election in 2016. He has been a member of the TPC for IEEE Africon 2013, ELECOM 2016 conferences.

Dr. V.Oree

Dr. Vishwamitra Oree is a Senior Lecturer in the Electrical and Electronic Engineering Department of the University of Mauritius. He holds a PhD in “Renewable Energy Systems Integration and Planning” from the University of Mauritius, a Masters degree in Electronic Engineering from the Grenoble Institute of Technology (ENSERG-INPG, France) and an undergraduate degree in Electrical and Electronic Engineering from the University of Mauritius. He has published several articles in leading international peer-reviewed journals as well as in proceedings of international conferences. His major research interests include renewable energy planning and microcontroller-based systems.

Mr. A.P. Murdan

Mr Anshu Prakash Murdan received his BEng.(Hons) in Electrical and Electronic Engineering, and his MSc in Information and Communication Technologies, from the University of Mauritius in 2000 and 2003 respectively. He is currently appointed as a Senior Lecturer in the Electrical and Electronic Engineering Department of the University of Mauritius. He is also pursuing his PhD in the field of power systems control engineering, and has published several articles in international peer-reviewed journals as well as in proceedings of international conferences. His major research interests include control and integration of renewables in power systems, smart grids, and internet of things (IoT).

Dr. O. Gukhool

Dr. Oomesh Gukhool received his BSc (Hons.) in Business Information System and his PhD in Computational Intelligence, from the University of Technology, Mauritius, in 2005 and 2011 respectively. He is presently a Senior Lecturer at the University of Mauritius, and his area of research is Computational Transportation Intelligence. He is supervising PhD students and leading research/consultancy projects in the development and implementation of computational intelligence to solve transportation problems

Mr Z. Doomah, MIHE, RPEM

Mr Z. Doomah received his BEng (Hons) degree in Civil Engineering with first class honours from the University of Mauritius in 2003 and MSc degree in Project Management with distinction from University of Mauritius in 2011. He is a Registered Professional Engineer with the Council of Registered Professional Engineers, Mauritius and a member of the Institute of Highway Engineers of the UK. He has worked extensively on the design, construction and management of major transport infrastructure projects in Mauritius and Seychelles. He joined the University of Mauritius as an academic in August 2018 and is presently a Lecturer in the Department of Civil Engineering of the University of Mauritius. His research interests include traffic and road safety engineering, intelligent transport solutions and resilient infrastructure.

Dr Sameerchand Pudaruth

Dr Sameerchand Pudaruth is a Senior Lecturer and Head of the ICT Department at the University of Mauritius. He has a PhD in Artificial Intelligence (AI) from the University of Mauritius. He also has an LLB from the University of London. He is a Senior member of IEEE, founding member of the IEEE Mauritius Subsection and the current Vice-Chair of the IEEE Mauritius Section. He is also a senior member of the Association for Computing Machinery (ACM). His research interests are Artificial Intelligence, Machine Learning, Data Science, Machine Translation, Computer Vision, Robotics, Mobile Applications, Web Technologies, Multimedia, Blockchain and Information Technology Law. He has written more than 50+ papers for national & international journals and conferences. He has been involved in several research projects funded by the Tertiary Education Commission (TEC), Mauritius Research Council (MRC) and the University of Mauritius (UoM). He has been in the organising committee of many successful international conferences such as Africon 2013, IST Africa 2014, Africon 2015, AfriCHI 2015, ICCCS 2015, BigData 2015, DIPECC 2015, Africhi 2016, Emergitech 2016, NextComp 2017, ISCOMI 2017, Mauritian Academic Conference 2018, icABCD 2018, Mauricon ICONIC 2018, icABCD2019, NextComp 2019, icABCD2020, Elecom 2020 and Mauricon ICONIC 2020. He has also written a book entitled, 'Python in One Week'. He is a reviewer for IEEE Access and Environment, Systems and Decisions (Springer) journals, amongst many others.

Mr Dejayasing Jogee

Deejaysing JOGEE holds an MSc in Environmental Engineering and an MBA from the University of Mauritius. He also has a professional qualification from the Engineering Council (UK) and is a graduate member of the Institution of Civil Engineers (UK). He is a Registered Professional Civil Engineer with more than 10 years' experience in the design, supervision, and management of government construction projects in Mauritius. He also has extensive construction materials testing experience acquired during his employment at the Material Testing Laboratory of the Ministry of Public Infrastructure. Before joining the public service, he has worked with local private building and civil engineering contractors on several large infrastructural projects. He joined the University of Mauritius in July 2014 and is presently Lecturer in Civil Engineering at the Faculty of Engineering. He is currently reading for a PhD degree studying the transfer mechanisms of contaminants from land to sea in two watersheds of Mauritius. His subject areas of interest include environmental engineering, engineering geology, and the application of geoinformatics in civil engineering.

International Faculty members:

Professor Dr. Zoran Bojkovic (Life Senior Member IEEE)

Zoran S. Bojkovic is full professor of Electrical Engineering University of Belgrade, Serbia, Life Senior Member of IEEE, full member of Engineering Academy of Serbia, member of Scientific Society of Serbia, member of Athens Institute for Education and Research ATINER. He was and still is visiting professor worldwide. He is author/co-author of more than 500 publications: monographies, books (Prentice-Hall, Wiley, Mc Graw Hill, Springer, CRC Press Taylor&Francis Group, IGI GLOBAL, WSEAS Press), book chapters, peer-reviewed journal, conference and symposium papers. Some of the books have been translated in China, India, Canada, Singapore. His research focuses on computer networks, multimedia communications, 3D video coding, smart grid, green communications, 5G and beyond. He is a highly regarded expert in the IEEE, contributing to the growth of communication industry and society reviewing process in many books and journals as well as organizing special sessions workshops and being General Chair and TPC member at numerous conferences all over the world. The other activities include serving as Editor-in-Chief and Associate Editor in international journals WSEAS, NAUN and IARAS. His publications: <http://www.zoranbojkovic.com/>

Lecturer Dragorad Milovanovic (Mr.Sc.EE)

Dragorad A. Milovanovic received the Diploma in Electrical Engineering (Dipl. Eng.) and Magister degree (Mr.Sc. EE) from the University of Belgrade, Serbia. From 1987 to 1991, he was a Research Assistant at the Department of Electrical Engineering. He has been working as R&D engineer for DSP software development in digital television industry. Also, he is serving as an ICT lecturer and consultant in digital media and medicine/sports informatics. He participated in research-innovation projects and published more than 275 papers in international journals and conference proceedings. He also, co-authored textbooks in area of multimedia communications published by Prentice Hall, Wiley, CRC Press, Springer-Verlag, IGI Global. Present projects include adaptive coding of 3D-Video immersive media, IoMT and Big media integration, 5G/6G wireless technology. His publications: <https://scholar.google.com/citations?user=R9AbAVEAAAAJ>