Smart Critical Infrastructure Center of Research Excellence

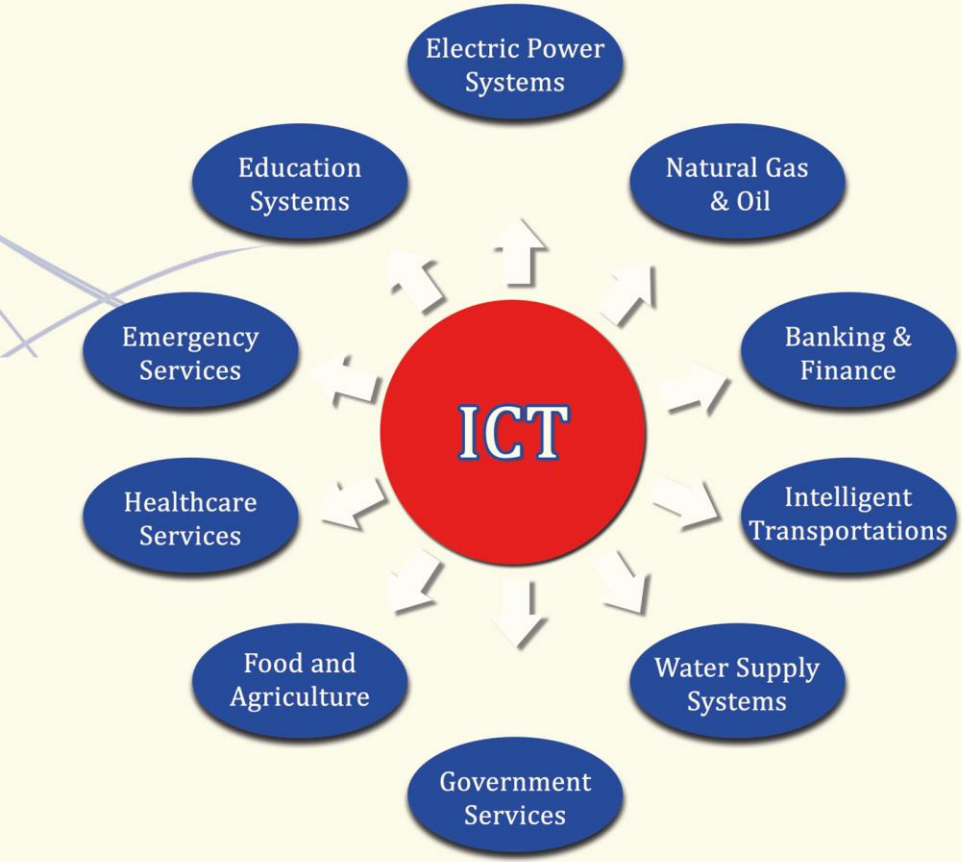
1st Call Projects

Vision

SmartCI aims to be a pioneering research institution that cooperates with government and private institutes in Egypt and middle east to resolve challenges facing the ever-evolving and increasingly essential integration between information and communication technology and critical infrastructure resources and services.

Mission

SmartCI targets to provide innovative solutions for the development of critical infrastructure through interdisciplinary and applied research that integrates Information and Communication Technologies with Critical Infrastructure systems. The center comprises a public-private partnership to provide an innovative engineering and science education model through integrated research and technology transfer services.


Electric Power Systems
Natural Gas & Oil
Banking & Finance
Intelligent Transportations
Water Supply Systems
Government Services
Food and Agriculture
Healthcare Services
Emergency Services
Education Systems
ICT

1st Call for Concept Paper

SmartCI Research Center to incubate up to 10 research teams in every cycle during their research proposals writing in a highly motivating environment and with monthly research incentives for up to 6 months.

SmartCI has two cycles each year, the table below shows the timeline of each cycle

	Cycle 1	Cycle 2
Submission opens	July 1st	January 1st
Submission deadline	August 1st	February 1st
Final decision	September 1st	March 1st

Project title	Real-time Big Data Analytics for Smart Traffic Mangement
Project PI	Dr. Iman Elghandour - Fac. of Eng., AU
Project Team	Dr. Mohammed Khalefa - Fac. of Eng., AU Eng. Ahmed Khalifa - Fac. of Eng., AU
Google scholar	http://scholar.google.com.eg/citations?user=L_MCU18AAAAJ&hl=en
Research area	Cloud Computing/ Real-time Big Data Analytics

Abstract

Road congestion is one of the major traffic problems in Egypt. Traffic congestion leads to time loss, wasted fuel, inability to forecast travel time, and preventing emergency vehicles from timely response. Intelligent traffic management help address some of the causes and consequences of traffic accidents and congestion. The project aims to build a real time big data analytics framework that uses GSM data, and information from social networks (e.g., Bey2ollak, waze.com, and twitter) to provide a universal real time traffic management system that helps

(1) Reduce congestion,
(2) Detect emergencies and accidents,
(3) Guide people in case of emergencies, and
(4) Estimate travel time for public transportation.

Project title	Automated Understanding of Scanned Arabic Documents
Project PI	Dr. Mohamed Elsayed - Fac. of Eng., AU Dr. Marwan Torki - Fac. of Eng., AU
Project Team	Eng. Mahmoud Fayyaz - Fac. of Eng., AU
Google scholar	
Dr. Elsayed's	http://scholar.google.com/citations?user=jCUt0o0AAAAJ
Dr. Torki's	http://scholar.google.com/citations?user=aYLNZT4AAAAJ&hl=en
Research area	Information and Communication Technology

Abstract

Optical Character Recognition (OCR) is a challenging task, whose difficulty depends on the nature of the document and on the document's language. In that context, handwritten documents are more difficult than printed ones, and some language scripting systems are more difficult than others. The Arabic scripting system is one of the most difficult for OCR. Moreover the research work on Arabic is generally relatively limited compared to Latin and Asian languages. One of the obstacles facing research in Arabic OCR is the lack of publicly available large datasets for training intelligent OCR systems, along with a standard benchmark tests on these datasets

The goal of this project is to advance the state of the art in recognizing and Arabic handwritten documents. The specific objects are the following:

- Collect a very large dataset of Arabic handwritten documents with ground truth.
- Create a benchmark evaluation framework for the collected dataset and make it publicly available for the research community.
- Conduct a thorough comparative study with state of the art techniques on the collected dataset.
  Use the dataset to experiment with multiple modern machine learning techniques that have never been applied before to Arabic OCR.

Project title	Prototyping a low-cost digital educational lab for Egyptian public schools
Project PI	Dr. Shaimaa Lazem- SRTA City
Project Team	Dr. Marwa Elteir- SRTA City
Research area	Computer science/ Education systems

Abstract

Using ICT technologies such as computerized curricula and educational games is proved to be very effective in improving learning experience of children. However, the cost of delivering such technologies to all governmental schools may not be afforded by the government.

This project incorporates knowledge from distributed systems and human-computer interaction to reduce the digital gap between the children and adults who have access to ICT facilities and those who don't due to their social, economic, or geographical reasons. Specifically, it aims to achieve the following goals:

- Create a prototype for a low-cost digital infrastructure that can be conveniently deployed in under-developed rural areas where IT services are either costly or not available.
- Reduce the cost of using ICT technologies in children's education through adoption of this infrastructure by public schools.
- Design educational applications to engage semiliterate adults in learning activities. The applications' interfaces will be designed to have minimal learning cost so that adults focus on the educational content of the application. The applications will be deployed in public spaces to transform learning to a service that semiliterate adults can get anytime, anywhere at their convenience.

Project title	A 24 GHz Radar for Automotive Applications
Project PI	Dr. Masoud ElGhoniemy - Fac. of Eng., AU
Project Team	Dr. Ahmed Allam - Electrical Eng., E-JUST Prof. Ramesh Pokharel - Electrical Eng., Kyushu University
Google scholar	http://scholar.google.com/citations?hl=en&user=lWGL8IcAAAAJ&view_op=list_works
Research area	Intelligent transportation

Abstract

Railroads play a major role in Egypt's economy through providing a cost effective means of transportation for humans and goods. Recently, the Egyptian railroads have been implicated by major accidents. The major source of these accidents has been attributed to miscommunications between the road crossing operators and the train driver. The primitive equipment use accentuates the effect of human errors.

Radars have been successfully introduced in the automotive industry for safety and leisure reasons. Automotive radar presents a systematic method of warning that reduces human intervention in accident prevention and control, which led to its widespread adoption in high-end cars.

Radars as collision warning and prevention systems can be an important part of the R&D policies to mitigate railroad accidents. The proposed radar is an extension to the radar currently used in automotive design that operates in the GHz range with added features that pertain to railroad. These features represent the characteristics of the railroads which include extended range, type of objects to be detected and the different warning types.

Project title	Cloud Based 3D Teleradiology for Rural Areas
Project PI	Dr. Mohamed Shaheen - CCIT, AAST
Project Team	Dr. Mohamed Kholief - CCIT, AAST Dr. Amr El Azab - CCIT, AAST
Research area	Healthcare services (Medical Image Processing)

Abstract

This Project will help in fast and accurate diagnosis for medical images. It is targeting to limit and minimize user interaction needed to process segmentation. Reports with automatically generated metadata describing the images will be saved and accessed through the Web. After the analysis of the 3D models, the generated reports can be saved to the patient medical records or integrated using medical standards like hl7.

This project supports teleradiology, which is the transmission of medical images from one location to another, a technology that is needed and currently is very expensive. There is still a lot of room for improvement and solving its accuracy, image quality, lossless image compression, and transmission speed problems. Focus on clinical governance, medico-legal issues and quality assessment should also be considered. The project will also provide:

- Radiologist desktop tools for speed diagnosis and reporting.
- Cloud based server side image processing for tablet and mobile.
- Cloud based Web access for reports and images using html5 interface.
- Archiving and retrieval system for old cases to help in statistical learning and educational purposes.

Project title	Better Understanding of Trabeculectomy via Numerical Modelling
Project PI	Dr. Mohamed Nasr - Fac. of Eng., AU
Project Team	Dr. Nader Bayoumi - Fac. of Medicine, AU
Research area	Numerical modelling / Ophthalmology

Abstract

Glaucoma is a characteristic optic neuropathy in which intraocular pressure (IOP) is a significant risk factor. Lowering of the IOP can be achieved medically or surgically. Surgical lowering of the IOP can be achieved by a number of surgical options, the most consistent and time-tested of which is the external fistulising operation, commonly known as Cairn's trabeculectomy.

Currently, the implementation of the trabeculectomy procedure is solely based on the surgeon skills and expertise, with no clear understanding of the engineering basics. The project aims to use numerical simulations to better understand the physics of trabeculectomy, along with some sensitivity analyses, in an effort to standardise its procedure.

Being able to standardise the trabeculectomy procedure and understand its physical basics will be a milestone in the field of glaucoma surgeries, which will lead to more consistent, repeatable and successful surgeries.

Specifically, the project targets to create a numerical model for the trabeculectomy operation, in an attempt to predict the flow of aqueous humour through the fistula created by the operation, and thus the expected reduction of IOP, at least in part.

Project title	Solutions for Next Generation FTTH Access Networks
Project PI	Dr. Ziad Elsahn - Fac. of Eng., AU
Project Team	Dr. Ahmed Farid - Fac. of Eng., AU Dr. Ali M. Elrashidi - Fac. of Eng., AU
Website	http://www.eng.alexu.edu.eg/~zelsahn/
Research area	Optical Communications

Abstract

This project will be looking at inexpensive solutions for next generation passive optical networks (PONs) aiming to:

- user bit rates higher than 1 Gb/s;
- longer PON reach; and
- larger number of users per optical line terminal (OLT).

Both green-field and brown-field deployment scenarios will be considered. To do so, we may consider wavelength-division multiplexed (WDM) PONs and try to address the design challenges and requirements. Further, we may be studying the possibility to use optical code-division multiple-access (OCDMA), subcarrier-multiplexing (SCM), optical orthogonal frequency-division multiplexing (OFDM), optical interleaved-division multiple-access (OIDMA), or some other hybrid techniques for next generation PONs. The use of coherent detection will also be addressed to enable high order modulation formats, and digital signal processing (DSP).

This research work will be focusing on both the system and device levels. The performance of the proposed solutions will be evaluated mainly via Matlab and Optisystem simulations, and possibly some basic experiments may be conducted.

Project title	Preparation and Characterization of Chalcopyrite Thin-Film Solar Cells Using Nano Technology Applications
Project PI	Dr. Hanaa AbouGabal - Fac. of Eng., AU
Project Team	Prof. Moataz Soliman - Fac. of Eng., AU & Institute of Graduate Studies & Research
	Eng. Sameh Hegazy - Fac. of Eng., AU
Research area	Renewable Energy

Abstract

As a result of Egypt's growing energy demand, the government plans to increase the amount of power generated from renewable sources, particularly wind and solar energy. Therefore, developing the technology of renewable energy can be regarded as a vital need in Egypt.

This project is concerned with one of the most important types of renewable energy, namely "the solar cells". This project aims is to produce a high performance chalcopyrite thin film solar cell applying innovative preparation ideas and treatments. The effect of the preparation techniques and conditions on the properties of each of the deposited films and consequently on, the cell performance as a whole, will then be studied. Chalcopyrite-type materials are selected as they are considered to be the most promising thin-film solar cell materials. They exhibit direct band gaps, well matched to the solar spectrum, in addition to their very favorable electronic properties.

Project title	Multi-layers polymeric solar cells with embedded nanostructures
Project PI	Dr. Nader Shehata- VT-MENA & Fac. of Eng., AU
Project Team	Dr. Islam Ashry - VT-MENA & Fac. of Eng., AU Dr. Ishac Kandas - VT-MENA & Fac. of Eng., AU
Google scholar	http://scholar.google.com/citations?user=H_Cz_B8AAAAJ&hl=en
Research area	Renewable Energy & Nanotechnology

Abstract

This proposal reports the fabrication of multi-layers polymeric solar cell with the integration of different nanostructures. Polymeric solar cells have many privileges because they are cheap (compared to silicon wafers or heterostructures), easy to be fabricated, and they do not need cleaning room processes. However, the main problem of the polymeric solar cells is the relatively low power conversion efficiency. Increasing the efficiency is the main target of this project through the deposition of different separate/combined layers including quantum dots (QDs), nonlinear polymers, fluorescent nanoparticles, and conductive nanofibers. The added materials would act as wavelength converters to get benefit of the unabsorbed wavelengths from the solar spectrum.

In this project, we report three different methods that could be used separately or combined to enhance the efficiency of polymeric solar cells. Spin coating and layer-by-layer (LbL) self-assembly techniques will be used to add QDs, nonlinear materials, and some fluorescent nanoparticles to polymeric solar cells during their fabrication. Additionally, electro-spinning process will be used to deposit conductive nanofibers over the polymeric solar cells to improve the conductivity of the generated photo-electrons from the active region to the electrodes.

Signing contracts

Writing Successful Grants Workshop
By Dr. Moustafa Youssef, 23 Oct., 2013

SmartCI Launch Event
By Pro. Sedki Riad & Dr. Mustafa Elnainay
22 Jun., 2013

SmartCI Orientation Session
By Dr. Mustafa Elnainay, 5 Oct., 2013

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