

# ITAC Achievements 2007-2011

## مبادرة دعم التعاون البحثي بين الشركات والجامعات

تهدف المبادرة إلى توفير الإطار الذي يمكن من خلاله بناء علاقات التعاون المشترك بين الجامعات والمراكز البحثية بهدف تطوير البحث العلمي وتشجيع الابتكار في مجال نظم المعلومات بما يحقق الفائدة للمجتمع ككل.

وتعتمد المبادرة في الأساس على مد يد العون من خلال ركيزتين أساسيتين الأولى برامج للباحثين والشركات وبمجموع 4 برامج والثانية برامج لطلبة الجامعات وتضم برنامجين، ويتم دعم تلك البرامج الستة بميزانية تقدر بـ 19 مليون جنيه سنويا.

ومن أهم هذه البرامج، برنامج تمويل مشروعات تطوير منتج والذي يوفر الفرصة لشركات تكنولوجيا المعلومات والاتصالات في استثمار الطاقات الإبداعية في مجال البحث العلمي لابتكار منتج جديد أو تطوير آخر موجود بالفعل.

ومن خلال هذا البرنامج، يتم نوع من الاتصال بين الشركات العاملة في مجال صناعة تكنولوجيا المعلومات والجامعات والمراكز البحثية وهو الأمر الذي يعضد مبدأ التواصل بين ميدان العمل والقطاع الأكاديمي. ويعد هذا التواصل ركنا من أركان التحرك صوب ربط الباحثين بسوق العمل للتعرف على احتياجاته وتلبية متطلباته بما يعود بالفائدة على صناعة تكنولوجيا المعلومات بشكل خاص والصناعة المصرية بشكل عام.

تقوم التسيير والمتابعة الخاصة بالمبادرة بالإضافة إلى لفيف من الأكاديميين ورجال الصناعة بدراسة الاقتراحات المقدمة والجهات البحثية لاختيار الأفضل من بينها، مع منح الجهة البحثية تمويل يصل إلى مليون جنيه عند عمل نموذج منتج أو مبلغ مليوني جنيه لتطوير منتج وذلك خلال مدة العمل التي تصل إلى 3 سنوات .

كما تتضمن برامج الأبحاث والشركات برنامجا لتمويل مشروعات الأبحاث المتطورة والذي يفتح الباب أمام الباحثين بالجامعات والمراكز البحثية بالتعاون مع شركات تكنولوجيا المعلومات للتقدم بمقترحات لمشروعات بحثية تتميز بالابتكار وإمكانية التطبيق العملي، وتقوم الهيئة بتحمل تكلفة المشروع كاملة بحد أقصى مليون جنيه للمشروع الواحد. ويساعد هذا البرنامج بشكل خاص على منح الباحثين فرصة للتفكير في احتياجات الصناعة الوطنية وابتكار المشروعات التي تساعد على الوفاء بها.

ومن البرامج المميزة أيضا برنامج منح الزمالة والذي يتم من خلاله اختيار عدد من مجالات الأبحاث التي تتميز بالابتكار وإمكانية التطبيق العملي لتغطية احتياجات الصناعة والسوق. وتوفر الهيئة من خلال هذا البرنامج الدعم المالي اللازم للباحث المتمثل في مرتب شهري بجانب تكاليف المعدات اللازمة لإتمام المشروع وذلك بقيمة إجمالية تصل إلى 130 ألف جنيه كحد أقصى ولمدة عام واحد فقط .

وحرصا على حماية حقوق الابتكار، تضم المبادرة برنامجا للتسجيل الدولي لبراءات الاختراع ويهدف بشكل أساسي لحماية وتشجيع الإبداع حيث تقوم الهيئة بتمويل براءات الاختراع سنويا بحد أقصى يصل إلى 15 ألف دولار سنويا للبراءة الواحدة.

وحول البرامج التي توفرها المبادرة لطلبة الجامعات، يأتي برنامج تمويل مشروعات التخرج في المقدمة من خلال توفيره للفرص أمام الطلبة في السنوات النهائية للحصول على تمويل مشروعات تخرجهم التي قد تواجه في الكثير من الأحيان بعوائق مادية قد تؤثر على جودتها مما ينقص من قدرة الطلبة على الإبداع .

ومن بين برامج المخصصة للطلبة أيضا ، برنامج التدريب الصيفي والذي تقوم الهيئة بالتنسيق من خلاله مع الهيئات والشركات المتميزة في مجال تكنولوجيا المعلومات لاستضافة الطلاب خلال فترة الإجازة الصيفية.

وتقوم الشركات خلال مدة التدريب بإشراك الطلبة في مشروعات جارية تنفيذها لبتاح لهم الاستفادة العملية من وتأهيلهم للمشاركة الفعلية في سوق العمل بعد التخرج، بينما تقوم هيئة تنمية صناعة تكنولوجيا المعلومات من جانبها بمنح مكافأة شهرية قيمتها 500 جنية لكل طالب بحد أقصى فترة تدريب تصل إلى شهرين .

وفيما يتعلق بعملية تقييم المشروعات الخاصة بالبرامج السابقة، تقوم لجنة التسيير والمتابعة الخاصة بالمبادرة بالاضافة الى لفيف من الاكاديميين ورجال الصناعة بتقييم أبحاث المشروعات ودرجة جودتها وإمكانية تطبيقها. كما تخضع المشروعات لعملية متابعة دقيقة بهدف التأكد من إتمام المراحل المختلفة بنجاح مع ربط الدعم المالي بالإنجاز الذي يحققه الباحث في مشروعه حسب التقديرات والمعايير الموضوعية.

#### اجمالي الدعم المقدم في كل برنامج منذ انطلاق المبادرة:

البرامج	2006	2007	2008	2009	2010	المجموع
مشروعات تطوير منتج	-	1,250,000	7,500,255	7,067,002	6,971,849	22,789,106
مشروعات الابحاث المتطورة	-	-	-	2,492,135	3,939,340	6,431,475
منح الزمالة			171,000	202,000		373,000
مشروعات التخرج	168,464	421,232	299,636	561,217	678,457	2,129,006
التدريب الصيفي	46,700	152,225	254,175	814,450	1,409,675	2,677,225
<b>المجموع</b>	<b>215,164</b>	<b>1,823,457</b>	<b>8,225,066</b>	<b>11,136,804</b>	<b>12,999,321</b>	<b>34,399,812</b>

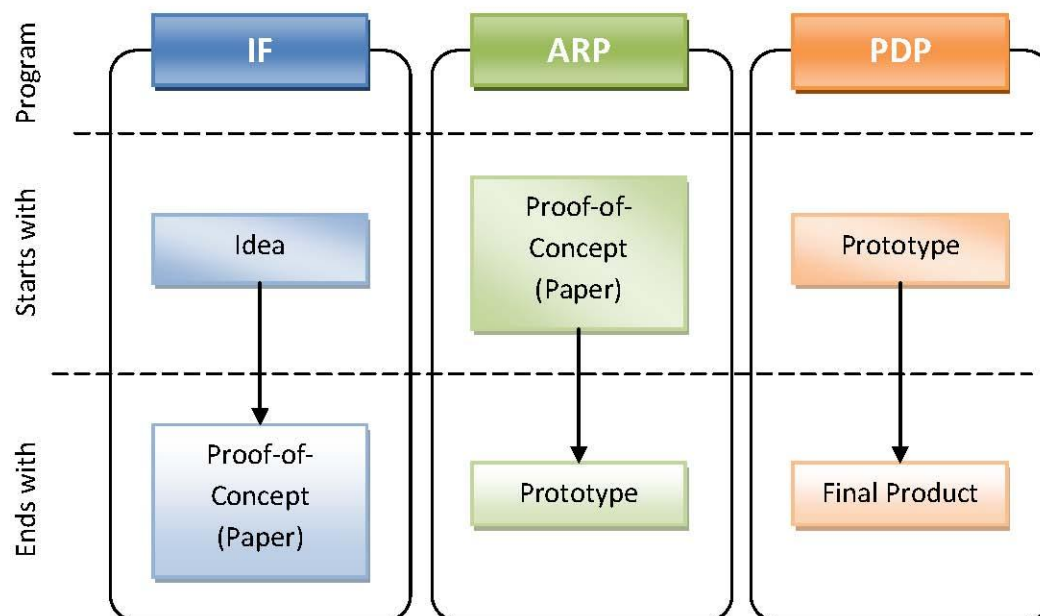
## INTRODUCTION

On 30/11/2006, ITIDA Board approved the introduction of the ITAC initiative in order to provide a framework that helps building cooperation between companies and research institutes through funding joint projects, which will yield to a positive impact on all parties as well as the national economy.

To achieve this objective the ITAC initiative translated the idea into a range of programs that can encourage and strengthen joint research and innovation in the ICT sector.

### Postgraduates Programs:

1. ITIDA Fellowship (IF)
2. Advanced Research Projects
3. Product Development Projects
4. Patent Filling Program (PFP)



### Undergraduates Programs:

1. Students Summer Training
2. Students Graduation Projects

ITAC announced its first call for proposals on July 2007 with allocated budget 5,100,000 EGP. As a result of the successful performance of the ITAC initiative, ITIDA Board approved the increase of the allocated budget to 19,100,000 EGP and then to 27,000,000 EGP after the addition of ITEA2 Program to ITAC programs.

### Maximum Fund per Project Type

Year Program	2006	2008	2009	2010	2011
IF	130,000 EGP	130,000 EGP	130,000 EGP	130,000 EGP	130,000 EGP
ARP	250,000 EGP	500,000 EGP	1,000,000 EGP	1,000,000 EGP	1,000,000 EGP
PDP	1,000,000 EGP	3,000,000 EGP	3,000,000 EGP	3,000,000 EGP	2,000,000 EGP
PPF	10,000 \$	15,000 \$	15,000 \$	15,000 \$	15,000 \$

### Overall Statistics

#### ICT Companies

Number of Participating Companies	Total No. of Submitted Projects	Total No. of Accepted Projects	Success Rate
137	227	44	19.4%

#### Academic Entities

No.	Entity	Total No. of Submitted Projects	Total No. of Accepted Projects	Success Rate
1	Public University	225	34	15.1%
2	Private University	60	9	15%
3	Institutes/Research Centers	22	1	4.5%
<b>Total</b>		<b>307</b>	<b>44</b>	<b>14.3%</b>

## Total Budgets for each program per year:

No.	Program	2006	2007	2008	2009	2010	Total
1	PDP	-	1,250,000	7,500,255	7,067,002	6,971,849	22,789,106
2	ARP	-	-	-	2,492,135	3,939,340	6,431,475
3	Fellowships			171,000	202,000	-	373,000
4	Graduation Projects	168,464	421,232	299,636	561,217	678,457	2,129,006
5	Summer Training	46,700	152,225	254,175	814,450	1,409,675	2,677,225
<b>Total</b>		215,164	1,823,457	8,225,066	11,136,804	12,999,321	34,399,812

## 1 Post Graduate Programs

Programs	No. of Submitted Projects	No. of Accepted Projects	Success Rate
PDP	154	21	13.6%
ARP	112	19	17%
IF	49	4	8.2%

### 1.1 Product Development Projects

PDP research grants target Egyptian researchers from universities/research centers based in Egypt in collaboration with ICT industries, who are willing to participate in an **innovative**, **applied**, and **competitive** research in Egypt.

A key element in the project is the existence of an *R&D* component that will require the collaboration of an Information and Communication Technology (ICT) industry partner and university/research institute member(s).

The PDP should start with a prototype and end with a final product.

The roles of the principal investigator (PI) and the industrial partner (IP) should be clearly defined. The contribution of the IP is expected to be higher in the PDP than in the ARP.

ITIDA will finance approved projects, which will contribute to ICT development, for a maximum duration of 3 years up to **2,000,000 L.E.**

## 1.2 Advanced Research Projects (ARP)

ARP research grants target Egyptian researchers from universities/research centers based in Egypt in collaboration with Information and Communication Technology (ICT) industries, who are willing to participate in an **innovative, applied, and competitive** research in Egypt.

A key element in the project is the existence of an *R&D* component that will require the collaboration of an ICT industry partner and university/research institute member(s).

The ARP should start with a proof-of-concept and end with a prototype.

ITIDA will finance approved projects, which will contribute to ICT development, for a maximum duration of 2 years up to **1,000,000 L.E.**

## 1.3 ITIDA Fellowship (IF)

The goal of the ITIDA Fellowship (IF) program is to promote scientific research by providing financial support to researchers from ICT companies or universities/research institutes.

The Fellowship proposal must start with an ambitious and innovative research idea and yield a publication in a renowned conference or journal in the field.

Researchers who successfully conclude their IF are automatically eligible to apply for the ARP program.

The fellowship can be offered to any of the following categories:

- M.Sc. students
- Ph.D. students
- Junior faculty members/researchers (assistant professor level) or post-doctoral researchers.
- Senior faculty members/researchers (associate or full professor level).

Highly qualified researchers are given fellowships to support their research with a maximum of **130,000 L.E.** per fellowship covering salary as well as cost of equipments and tools for the researcher.

## 1.4 Patent Filling Program (PFP)

PPP aims to encourage, protect and motivate creativity and innovation. ITIDA will support filing a number of patents per year with a maximum of **15,000 Dollars** per patent.

No. of Submitted Patents	No. Of Accepted Patents
8	2

### Selected Patents for Funding:

#### 1- VIRTUAL LABORATORY SMART AGENT

**Applicant's Name:** Tarek Mahmoud Ellesseily – Silicon Vision Company

Ahmed Kamal El-Din Abou-el-Yazid

**Technical Fields:** Cloud Computing, Virtualization Management, E-learning

**Country Filed:** US-PTO (United States – Patent Trademark Office)

#### 2- A DECIMAL FULLY PARALLEL FLOATING POINT FUSED MULTIPLY ADD UNIT

**Applicant's Name:** Mostafa Maarouf El-Khouly – SilMinds Company

**Technical Fields:** Floating-Point units, Decimal Arithmetic and Computer Architecture

**Country Filed:** United States of America

## 2 Undergraduates Programs

### 2.1 Students Graduation Projects

ICT companies provide proposed subjects for graduation projects, based on market needs. Selected student graduation projects are funded through ITAC with a maximum of 10,000 L.E. per project.

Total No. of Submitted Projects	Total No. of Accepted Projects	Success Rate
672	392	58.3%

### 2.2 Students Summer Training

ITIDA offers the students practical on job training during the summer vacation in the largest ICT companies in Egypt. The objective of this program is to help students to get prepared for their future professional life and enhancing their educational capabilities as well. ITIDA will grant each student **500 L.E.** per month during the training period up to a maximum of 2 months

No. of Students	No. of Participating Companies
4657	64

# Funded Projects Summary

- PDP
  - Completed
  - Ongoing
  - New
- ARP
  - Completed
  - Ongoing
  - New
- Fellowships
  - Completed
  - Ongoing
  - New

# Completed PDP Projects

**Project Title:** Security System based on human IRIS structure

**Project Start Date:** July, 2007

**Project End Date:** December, 2008

**ITAC Fund:** 250,000 EGP

**Industrial Partner:** The Engineering Office for Integrated Projects (EOIP)

**Industrial Partner Contact Person:** Dr. Mohamed Riad Elghoneimy

**PI Name:** Dr. Magdy Fikry

**Academic Partner:** Faculty of Engineering Cairo University

### **Project in brief:**

This project aims at developing a prototype for a human biometric security system to be used as an inexpensive and reliable identification/verification instrument. The human iris will be relied upon as the biometric for person identification/verification. Since the visual texture of the human iris is unique it can be used as a distinctive feature for any person. The unique features of the iris include the trabecular meshwork (the tissue that gives the iris its "radial" impression), as well as other physiological properties such as the freckles, furrows, rings, and the corona. Iris recognition technology is deemed to be among the most stable and reliable of the biometric technologies available today. This is so because the structure of the iris rarely changes during the lifetime of the individual, and also because no two irises are alike.

The iris image capture device conventionally used is an expensive infrared high resolution digital camera. The recent availability of commercial high-resolution digital cameras operating at low illumination levels offers an opportunity for using an inexpensive iris image capture device. The methodology of the project shall be based on implementing the iris recognition algorithm developed by one of the research team members, using a DSP/FPGA – based development kit interfaced to a high-resolution commercial digital camera for iris image capture.

To facilitate project outcomes evaluation, a suitable database shall be selected and prepared for evaluating the correctness of the algorithm recognition capability. Algorithm evaluation using Matlab tools shall be performed during the development of the prototype platform. Software and hardware of the prototype shall be developed in parallel, followed by a system integration phase to properly tune the system. Final testing and evaluation will then be carried out on the developed prototype.

**Project Title:** E-Stock Market Consultant (ESMC)

**Project Start Date:** July, 2007

**Project End Date:** January, 2009

**ITAC Fund:** 1,000,000 EGP

**Industrial Partner:** Egytec Engineering

**Industrial Partner Contact Person:** Eng. Amr Shawki

**PI Name:** Dr. Mohamed Hassan Rasmy

**Academic Partner:** Faculty of Computers and Information Cairo University

### **Project in brief:**

One of the main problems that face Finance Professionals, Investment Analysts, and Brokers, is the problem of Predicting & Forecasting the direction of the Stock Market to get a suitable Investment Decisions by acting appropriate Trend Signals depending on the Stock Market Direction. This is referred to as the "Market Timing" problem. The proposed project is a Web-based Financial Consultant System designed specifically for individual investors and professional traders conducted from unbiased research. It offers recommended trend signal for each stock in terms of Very Bullish, Bullish, Neutral, Bearish, and Very Bearish Stock. Which enable the investor/trader to effectively taking a suitable investment decisions regarding his/her stocks. The proposed project as a Quantitative Method Solution aims to maximize the expected profit and minimize the risk related to the stocks during the Trading stage. By creating a new indicator, that combines Technical Analysis, Artificial Intelligence, and Statistics into one basket. This indicator will have the merit of putting the investor on the right track to ride major market trends, and to take advantage of short-term adverse market movements. Most of the market participants lack the ability to think wisely and to have discipline when investing in the stock market. This is because the emotional pressure plays a big role in leading to irrational behavior, especially during sudden and sharp moves that occur contrary to expectations.

**Project Title: Advanced Platform for Processing Medical Images of the Heart**

**Project Start Date:** July, 2008

**Project End Date** June, 2010

**ITAC Fund:** 1,000,000 EGP

**Industrial Partner:** Intelligent Designs (now Diagnosoft Egypt)

**Industrial Partner Contact Person:** Dr. Ayman Mahmoud Khalifa

**PI Name:** Dr. Nael Osman

**Academic Partner:** Nile University

**Project in brief:**

Because of the current demand for sophisticated analysis tool for the novel sophisticated imaging of the heart, the project aims to build a comprehensive platform for analyzing the different types of heart images obtained by MRI and fuse the information together.

This will enable doctors to detect diseases earlier and with improved accuracy. In turn, early diagnosis leads to less expensive and less invasive treatment options. Cardiologists value a more precise diagnosis because it allows them to be more aggressive in their treatment of a specific heart region.

**Market Impact:**

**Present contracts/agreements:**

Total current revenue since January 2009 until today is \$600,000 USD. All the revenue is from international sales. The table below shows some of the lead customers we have.

Institute	Country	State	Product
Cincinnati Children's Medical Hospital	USA	Ohio	HARP License
University of Florida	USA	Miami	PLUS License
NIH - National Institutes of Health	USA	Maryland	HARP License
Vanderbilt University	USA	Tennessee	HARP License
The Cleveland Clinic	USA	Ohio	HARP License
University of Minnesota	USA	Minnesota	HARP License
John Hopkins University	USA	Maryland	HARP License
University of Texas Southwestern Medical Center	USA	Houston	HARP License
University of Washington	USA	Missouri	HARP License
Catholic Health Systems/ St. Francis	USA	New York	HARP License
Children's Hospital of Philadelphia	USA	Pennsylvania	HARP License
UPMC	USA	Pennsylvania	HARP License
Carnegie Mellon	USA	Pennsylvania	PLUS

New Castle University	UK		HARP License
Derby Hospitals	UK		HARP License
University of Leicester	UK		PLUS
Phillips Electronics Korea	Korea		SENC Consulting
Hokkaido University - Philips Japan	Japan		SENC License
Phillips Electronics Japan	Japan		SENC Consulting
Sapienza University of Rome	Italy		HARP License
All India Institutes of Medical Sciences – Phillips	India		HARP License
RWTH Aachen University	Germany		SENC License
University of Witten/Herdecke/Hellios	Germany		HARP License
University of California - San Fransisco	CA	San Francisco	PLUS License
Unversity CL Brussels	Belgium		HARP License
Erasme Hospital	Belgium		HARP License
Royale Adelaide Hospital	Australia		HARP License

#### **Patents related to the project:**

“Three-Dimensional Magentic Resonance Motion Estimation of a Single Image Plane,” (ZHARP), Jerry L. Prince, Matthias Stuber, Nael F. Osman, and Khaled Z Abd-Elmoniem, No, 7,495,438, Issued 24 February 2009.

#### **Published Papers related to the project:**

1. Korosoglou G, Osman NF, Denglera TJ, Riedle N, Steen H, Lehrke S, Giannitsis E and Katus HA, “Strain-Encoded Cardiac Magnetic Resonance for the Evaluation of Chronic Allograft Vasculopathy in Transplant Recipients,” *American Journal of Transplantation*, 2009; 9: 2587–2596.
2. Basha TA, Ibrahim ES, Weiss RG, and Osman NF, “Cine cardiac imaging using black-blood steady-state free precession (BB-SSFP) at 3T,” *J Magn Reson Imaging*, 2009 Jun 25;30(1):94-103.
3. Korosoglou G, Dengler TJ, Osman NF, Giannitsis E, and Katus HA, “Single coronary artery arising from the right sinus of valsalva: 'one-stop-shop' of coronary anatomy and functional significance by cardiovascular magnetic resonance,” *Clin Res Cardiol*, 2009 Feb;98(2):133-6. Epub 2008 Oct 30.
4. Korosoglou G, Futterer S, Humpert PM, Riedle N, Lossnitzer D, Hoerig B, Steen H, Giannitsis E, Osman NF, Katus HA, “Strain-encoded cardiac MR during high-dose dobutamine stress testing: comparison to cine imaging and to myocardial tagging,” *J Magn Reson Imaging*, 2009 May;29(5):1053-61.

5. Hamdan A, Thouet T, Kelle S, Wellnhofer E, Paetsch I, Gebker R, Schnackenburg B, Fahmy AS, Osman NF, Bornstedt A, Fleck E, "Strain-encoded MRI to evaluate normal left ventricular function and timing of contraction at 3.0 Tesla," J Magn Reson Imaging, 2009 Apr;29(4):799-808.
6. Neizel M, Lossnitzer D, Korosoglou G, Schäufele T, Lewien A, Peykarjou H, Steen H, Ocklenburg C, Giannitsis E, Katus HA, and Osman NF "Strain-Encoded MRI for Evaluation of Left Ventricular Function and Transmurality in Acute Myocardial Infarction," Circ Cardiovasc Imaging 2009;2 116-122, <http://circimaging.ahajournals.org/cgi/content/abstract/2/2/116>
7. Korosoglou G, Lossnitzer D, Schellberg D, Lewien A, Wochele A, Schaeufele T, Neizel M, Steen H, Giannitsis E, Katus HA, and Osman NF, "Strain-Encoded Cardiac MRI as an Adjunct for Dobutamine Stress Testing: Incremental Value to Conventional Wall Motion Analysis," Circ Cardiovasc Imaging 2009;2 132-140, <http://circimaging.ahajournals.org/cgi/content/abstract/2/2/132>.
8. Fahmy AS, Basha TY, and Osman NF, "Inherent Fat Cancellation in Complementary Spatial Modulation of Magnetization," Magn Reson Med. 2009 Jan;61(1):234-8.
9. Sampath S, Osman NF, Prince JL, "A combined harmonic phase and strain-encoded pulse sequence for measuring three-dimensional strain," Magn Reson Imaging. 2009 Jan;27(1):55-61.
10. Neizel M, Lossnitzer D, Korosoglou G, Schäufele T, Lewien A, Steen H, Katus HA, Osman NF, Giannitsis E., "Strain-encoded (SENC) magnetic resonance imaging to evaluate regional heterogeneity of myocardial strain in healthy volunteers: Comparison with conventional tagging." J Magn Reson Imaging. 2009 Jan;29(1):99-105.
11. Hamdan A, Thouet T, Sebastian K, Paetsch I, Gebker R, Wellnhofer E, Schnackenburg B, Fahmy AS, Osman NF, Fleck E, "Regional right ventricular function and timing of contraction in healthy volunteers evaluated by strain-encoded MRI" J Magn Reson Imaging. 2008 Dec;28(6):1379-85.
12. Korosoglou G, Dengler TJ, Osman NF, Giannitsis E, Katus HA, "Single coronary artery arising from the right sinus of valsalva: 'one-stop-shop' of coronary anatomy and functional significance by cardiovascular magnetic resonance.," Clin Res Cardiol. 2008 Oct 30.
13. The following is a list of conference papers accepted by the team at the Nile University and written by the research assistants funded by the ITIDA grant:
14. Mustafa ElAttar, Nael F. Osman and Ahmed S. Fahmy, "Myocardial Segmentation Using Constrained Multi-Seeded Region Growing" - ICIAR'2010, Povoá De Varzim, Portugal
15. Mustafa A. AlAttar, Abdallah G. Motaal, Nael F. Osman and Ahmed S. Fahmy, "Performance Evaluation Of Cardiac MRI Image Denoising Techniques" - CIBEC'08, Cairo, Egypt.
16. Abraam S. Soliman, William S. Kerwin, Nael F. Osman, "MR Harmonic Phase Surface for Tracking Cardiac Motion", Society for Cardiovascular Magnetic Resonance (SCMR) 13th annual Scientific Sessions, 2010, Phoenix, AZ.
17. Abraam S. Soliman and Nael F. Osman, "3D Motion Tracking of the Heart Using Harmonic Phase (HARP) Isosurfaces", SPIE Medical Imaging, 2010, San Diego, CA.
18. Mina E. Khalil, Ahmed S. Fahmy, Nael F. Osman, "Correction of Left Ventricle Strain Signals Estimated from Tagged MR Images", International Conference on Image and Signal Processing (ICISP), 2010, Quebec, Canada.

19. Mohamed K. Metwally, Neamat El-Gayar and Nael F. Osman, "Improved Technique to Detect the Infarction in Delayed Enhancement Image Using K-mean Method" ICIAR'2010, Povo De Varzim, Portugal.
20. Abdallah G. Motaal, Naemat-ElGayar and Nael F. Osman, "Automated Cardiac-Tissue Identification in Composite Strain-Encoded (C-SENC) Images Using Fuzzy K-Means and Bayesian Classifier ", iCBBE 2010, Chengdu, China.
21. Abdallah G. Motaal and Nael F. Osman, "Strain Correction in Interleaved Strain-Encoded (SENC) Cardiac MR", SPIE Medical Imaging, 2010, San Diego, CA
22. Abdallah G. Motaal, Naemat-ElGayar and Nael F. Osman, "Different Regions Identification in Composite Strain Encoded (C-SENC) Images Using Machine Learning Techniques", ANNPR 2010, Springer LNAI 5998.
23. Abdallah G. Motaal, Mustafa A. AlAttar, Nael F. Osman and Ahmed S. Fahmy, "Cardiac MRI STEAM Images Denoising Using Bayes Classifier" - CIBEC'08, Cairo, Egypt.

## Project Title: Miniature MEMS Spectrometer

**Project Start Date:** April, 2008

**Project End Date:** January, 2010

**ITAC Fund:** 2,000,000 EGP

**Industrial Partner Name (Company):** Si-Ware Systems

**Industrial Partner Contact Person:** Dr. Bassam Saadany

**PI Name:** Dr. Diaa A. M. Khalil

**Academic Partner:** Faculty of Engineering Ain Shams University

### **Project in brief:**

The proposed product offers a break through Infra-Red (IR) spectrometer capitalizing on innovative MEMS technology. This product will introduce for the first time in industry a miniature MEMS spectrometer that utilizes the de facto standard technique of Fourier Transform spectroscopy. Being a MEMS based sensor, the spectrometer enjoys the benefits of microelectronics technology, such as batch processing, small size (allowing for mobile and hand held equipment) and lower production cost (typically an order of magnitude). This in turn promises market size expansion due to the new applications associated with such features.

Recently, it has been proposed to fabricate optical splitters within optical interferometers using Si/Air interfaces using deep reactive ion etching technology. Optical measurements have been carried on the MEMS interferometer showing its ability to work as a part of an FT-IR spectrometer with a resolution of 10nm. Also the optical measurements have shown the possibility of noise reduction using the proposed MEMS interferometer.

This proposal has been patented by Si-Ware Systems of Egypt in Europe, USA and Japan.

This MEMS spectrometer represents a breakthrough in the field of optical spectrometers working in the infrared region. The spectrometer takes benefit of the MEMS technology and relies on a new idea suitable to provide a remarkable product. The product is remarkable for its size, performance and price allowing it to strongly compete in the international market.

### **Market Impact:**

#### **Present contracts/agreements:**

- 1) Product joint development agreement signed in November 2008 between Si-Ware Systems, Egypt and Hamamatsau Photonics HPK, in Japan, for the joint development of Si-Ware's FTIR MEMS Spectrometer.
- 2) In October 2009 a product licensing agreement has been signed between Si-ware systems, Egypt and Hamamatsau Photonics HPK in Japan. According to this agreement, Si-ware licenses manufacturing and commercialization of its FTIR MEMS Spectrometer to HPK against an agreed upon royalty.
- 3) By-product feasibility study agreement (signed, September 2010), between Si-ware systems, Egypt and Hamamatsau Photonics HPK in Japan. Capitalizing on successful validation of Spectrometer process technology. The target of the agreement is to study feasibility of a MEMS by-product of Spectrometer,

targeting the high growth market of Optical Coherence Tomography (OCT) applications.

#### **Patents related to the project:**

- 1) "System, Method and Apparatus For a micromachined interferometer using optical splitting", EP1906159 (B1); US7796267 (B2), JP2008102132 (A) Granted EPO; Granted USPTO; Pending JP
- 2) "Long Travel Range MEMS Actuator" US 12/761,621; PCT/US2010/031380, pending/International (published)
- 3) "An Opto-Mechanical Optical Path Retardation Multiplier for Optical MEMS Applications", US 12/762,068; PCT/US2010/031467, pending/International (published)
- 4) "Compensated MEMS FTIR Spectrometer Architecture" US 12/877,888; PCT/US2010/048169, Pending/International (published)
- 5) The shifted Spectral Domain OCT Technique and its Fabrication in Optical MEMS Technology", US 61/296,403, Pending
- 6) "Electronics for MEMS based Systems", US 61/311,966, Pending

#### **Published Papers related to the project:**

- 1) Daa Khalil, Yaser Sabry, Haitham Omran, Mostafa Medhat, Amr Hafez, and Bassam Saadany, "Characterization of MEMS FTIR Spectrometer", Accepted for publication, SPIE Photonics west 2011, USA.
- 2) Daa Khalil, Haitham Omran, Mostafa Medhat, and Bassam Saadany, "Miniaturized tunable integrated Mach-Zehnder MEMS interferometer for spectrometer applications", Invited talk at SPIE Photonics West in San Francisco, California, USA, 23-28 January 2010.
- 3) Daa Khalil, "The Si Optical Bench Technology: Challenges and Opportunities", Invited talk at The 6<sup>th</sup> International Symposium on "High-capacity Optical Networks & Enabling Technologies" (HONET' 09), Alexandria, Egypt, Dec. 2009.
- 4) Haitham Omran, Mostafa Medhat, Bassam Saadany and Daa Khalil, "Mach-Zehnder MEMS Interferometer with Two Si/Air Beam Splitters", IDT09, , Riyadh , Kingdom of Saudi Arabia, 8-11 November, 2009.
- 5) B. Saadany, H. Omran, M. Medhat, D. Khalil, and T. Bourouina, "MEMS Tunable Michelson Interferometer with Robust Beam Splitting Architecture", IEEE/LEOS International Conference on Optical MEMS and Their Applications, August 2009, USA
- 6) Y. Sabry, M. Medhat, B. Saadany, A. M. E. Safwat and D. Khalil, "Optical Characterization Technique for MEMS Comb-Drive Resonators", IEEE/LEOS International Conference on Optical MEMS and Their Applications, August 2009, USA

**Project Title:** Virtual Tutor

**Project Start Date:** April, 2008

**Project End Date:** October, 2009

**ITAC Fund:** 1,000,000 EGP

**Industrial Partner Name:** The Engineering Company for developing Digital Systems (RDI)

**Industrial Partner Contact Person:** Eng. Abdelrahman Rashwan

**PI Name:** Dr. Mohsen Rashwan

**Academic Partner:** Faculty of Engineering Cairo University

### Project in brief:

The project deliverable is authoring tools for interactive books that integrate state-of-the-art human language and communication technologies to provide students with effective learning experiences. These books use talking faces as virtual tutors that 'talks' to the student, introduces and explains lessons, provides instructions and explanatory feedbacks, and asks comprehension questions, while providing verbal and nonverbal cues (head movements). Also besides the conventional input modalities, mouse and keyboard, these interactive books allow the user to speak with the Virtual Tutor using the Automatic Speech Recognition (ASR) technology to answer the questions. Also the user can use the speech interface to browse the book and move to a specific part of it.

### Market Impact:

#### Present contracts/agreements:

- 1) Completed a contract with "King Saud University", Saudi Arabia for developing an Education Management Electronic System (EMES) that enables blind students to have access to the e-courses.
- 2) Completed a contract with "World Islamic Call Society" Libya to convert several books to ebook versions
- 3) Completed a Contract with a publishing agency in the Sultanate of Oman, to convert several books and courses for ebook versions
- 4) Submitted an offer for large educational tenders to develop e-courses for all the education levels. The offer was based on the last version of the Virtual Tutor Educational package.

#### Future contracts:

Negotiating a contract with a major TV station in the Gulf area for enabling its news website for blind users.

#### Published Papers related to the project:

Mohsen A. A. Rashwan, Mohamed A.S.A.A. Al-Badrashiny, Mohamed Attia, Sherif M. Abdou, Ahmed Rafea" A Stochastic Arabic Diacritizer Based on a Hybrid of Factorized and Un-factorized Textual Features", IEEE Transactions on Audio, Speech and Language Processing, November 2010 ( **a paper on RDI leading technology for text diacritization**).

**Project Title: Web-based Management System for Power Meters' Measurements**

**Project Start Date:** May, 2008

**Project End Date** July, 2009

**ITAC Fund:** 590,000 EGP

**Industrial Partner:** Edge Technology

**Industrial Partner Contact Person:** Eng. Ramy Sayed Ali

**PI Name:** Dr. Raafat Elfouly

**Academic Partner:** Faculty of Engineering Cairo University

**Project in brief:**

The objective of this project is to implement an Integrated System for data collection, data transfer, and control of power meter data. Software will be developed to be able to handle a wide range of meters from different vendors using different industrial communications protocols. The Software should run on any standard PC or compatible computer for stand-alone applications to support data collection, validation, editing, control and analysis. The project is to be based on modern Communication systems available in the market like GSM / GPRS / LAN / WAN / WIFI / RF. The system is intended to serve a wide range of customers in different fields including thousands of power utility operations, government and university users, panel builders, and power generation & distribution facilities.

**Market Impact:**

**Present contracts/agreements:**

**1) Energy Management System–EMS**

- a. Ministry of Water and Electricity MoWE, Riyadh, KSA  
Edge Technology was invited in Sep 2009 by KSA- MOWE, to employ the first EMS in KSA, for 10 Factories load monitoring. Contact has been signed to complete the sites from Nov 2010-June 2011.

**2) Street Lighting Management System–LCS**

- a. Riyadh governorate, Riyadh, KSA  
Edge Technology was contacting with Riyadh governorate to deploy the LCS for 26,000 street lighting poles for the period starting from March 2010 and for 3 years.
- b. Giza governorate, Giza, Egypt  
LCS was deployed in 3 areas in the Giza governorate since Feb 2010. The system serves many features that include energy saving.
- c. Al-Ahram Advertising Agency, Cairo, Egypt  
Edge Technology applies its LCS to serve the Advertising agencies to monitor to uni-pole bill-boards since early 2010. Negotiations are in the final phase with Al-Ahram.

**3) Partnership with Saudi Delta Enterprises, Riyadh, KSA (since Jan 2008)**

**4) Intel Partnership ( since March 2009)**

**Patents related to the project:**

One filed patent at the Egyptian Patent Office in 2010.

**Project Title: DNA Profiling System & Biomedical Applications**

**Project Start Date:** October, 2008

**Project End Date:** September, 2010

**ITAC Fund:** 1,000,000 EGP

**Industrial Partner:** Data Management Systems (DMS)

**Industrial Partner Contact Person:** Eng. Magdy Khair-Allah

**PI Name:** Dr. Essam Khalifa

**Academic Partner:** Faculty of computers and Information Ain Shams University

**Requested Minor Extension:**

**Time:** 4 months      **Budget:** L.E 200,000

**Project in brief:**

Two years of research, cooperation, supervision and financial support by the Information Technology Industry Development Agency (ITIDA), Ain Shams University and Data Management Systems(DMS) Company have culminated in the production of the First Egyptian DNA profiling system, a system that covers paternity testing, human identification, Y-Chromosome applications, and population genetics & race detection.PS. The product crystallized the sophisticated scientific and research capabilities of the research team, headed by Prof. Dr. M. Essam Khalifa and the in-depth knowledge of the market needs of the Data Management Systems(DMS) Company.

The product utilizes the latest DNA-based technologies to aid in forensic investigations and biomedical applications which provides great support to various governmental and scientific organizations in their work. The objectives of the product are: to support investigators to identify victims in different disasters such as explosions, earthquakes, accidents and terror attacks, to help investigators to detect the identity of potential suspects by linking them to biological evidence in different crimes, to guide courts in proving or denying the paternity of a parent to his child, and to reveal the race of unknown persons and tracing species' mutations. The impact of this endeavor has also reached academia where the Faculty of Computers and Information Science, Ain Shams has established a new Bioinformatics Program to support Research and Development in this important area.

**Market Impact:**

**Present contracts:**

- Today, Data Management Systems (DMS) started marketing the new product to all its already existing base of customers; a wide range of hospitals around the Middle East area. The system is already being used now by the **Egyptian Ministry of Internal Affairs**, to solve critical cases; including the investigations of the deadly explosion in front of the Two Saints' church in Alexandria. The product was declared in the first proposal more than two years ago as a national-security necessity. Today, this declaration is practically realized.

- On the other hand, the product opens a great opportunity for postgraduate students to use as a solid base on which they can build new extensions and add new features.

#### **Future contracts:**

- For the market, the sky is the limit. Data Management Systems (DMS) is planning to utilize the product – after extending its capabilities – for DNA-based diseases detection and forecasting. DMS expects that in one year from now, many MENA hospitals will be using the new product, and many bio-informatics' research institutes will conduct very valuable research which will be all based on the current systems and its new extensions

**Project Title: RFID-Based Hospital Positioning System**

**Project Start Date:** October, 2009

**Project End Date:** September, 2010

**ITAC Fund:** EGP 368,000

**Industrial Partner:** Crescent Technologies Inc.

**Industrial Partner Contact Person:** Dr. Bassel Tawfik

**PI Name:** Dr. Ahmed Samir Fahmy

**Academic Partner:** Faculty of Engineering Cairo University

**Requested Minor Extension:**

**Time:** 4 months      **Budget:** L.E 72,000

**Project in brief:**

Accurate and timely visibility of both people and asset flow inside high risk environments, such as healthcare and high security facilities, can improve workflow and reduce accidents dramatically. Because of its obvious benefits, the global market for RFID applications in the healthcare sector alone is expected to cross the \$2 billion border by 2016. Meanwhile, the problem of real-time accurate object localization using RFID technology is technically challenging. Crescent Technologies has therefore pursued a project to build an RFID-based system for identifying and tracking objects within healthcare facilities. Based on in-house novel localization algorithms coupled with our unique expertise in hospital workflow analysis and medical equipment management, our system manages the collection, processing, and analysis of location data based on RFID infrastructure. Currently, a number of pilot studies are being implemented with a number of international and regional customers.

**Market Impact:**

**Present contracts:**

1) Product: RFID-based Management System for Medical Devices and Spare Parts.

Customer: Express Systems Inc., Cleveland, Ohio, USA.

2) Product: RFID-enabled Blood bank Management System

Customer: The Blood Bank Center, ElZeraeyeen Hospital, Cairo, Egypt.

**Future contracts:**

1) Product: RFID-based Localization system for Neonatal Care Units

Customer: Innovative Technology Inc., Al Riyadh, KSA.

2) Product: RFID-enabled Blood bank Management System

Customer: The Blood Bank Center, ElHaram Hospital, Cairo, Egypt.

**Business agreements:**

Marketing and Distribution of Developed Products:

Innovative Technology Inc., Al Riyadh, KSA.

**Patents:**

Title: Object Localization Using Radio Frequency Identification and Back Projection algorithms.

Registry # 1476/2010 (Egyptian IP Office)

**Published Papers:**

Elsayeh M, et al, "RFID Based Tagless-Object Localization Using Back Projection,"  
Conf. Proc. of CIBEC, Dec 2010.

**Workshops and Events:**

8th Global Mobility Roundtable (GMR), Marriott Hotel, Cairo (2009)

Euro-Mediterranean Innovation Marketplace, Fairmont Hotel, Cairo (2010)

**Project Title: Intelligent Information Discovery & processing system**

**Project Start Date:** September, 2008

**Project End Date:** March, 2010

**ITAC Fund:** 948,960 EGP

**Industrial Partner:** HARF

**Industrial Partner Contact Person:** Eng. Samy Abdelrahman

**PI Name:** Dr. Mohamed Hashim Abdelaziz

**Academic Partner:** Faculty of Computers and Information Zagazig University

**Project in brief:**

Project builds an integrated system that enables any enterprise individual to access all publicly available human knowledge of interest efficiently and effectively from a personalized site. The knowledge is assembled from the WWW.

Intelligent Information Discovery & Processing System (IIDPS) - commercially called Jumana System is a system that aims to gather information from the internet pages and applying some processes upon them to achieve the following goals:

- Downloading relevant documents from publicly available sources on the internet.
- Cleaning and filtering these documents.
- Classifying these documents on a comprehensive taxonomy of multiple levels.
- Summarizing these documents.
- Preparing printed reports automatically or manually.
- Publishing these documents on a local personalized site.

**Project Title: Universal Ethernet WIFI Enabled RFID read/write transceiver**

**Project Start Date:** October, 2008

**Project End Date:** September, 2010

**ITAC Fund:** 1,000,000 EGP

**Industrial Partner:** Alfa Electronics

**Industrial Partner Contact Person:** Eng. Adel Adib

**PI Name:** Dr. Hany Selim

**Academic Partner:** Faculty of Engineering Assuit University

**Project in brief:**

RFID was introduced in many applications ranging from tracking tasks for nuclear materials and even for cattle to contactless monetary cards and ID cards. Their countless fields of applications include logistic control, supply chain merchandise tagging and in hospitals, libraries and manufacturing.

Barcode tagging is nowadays extensively used for identification. But not like the ubiquitous barcode, RFID does not require line of sight access to be read, also reader and RFID tag are not orientation sensitive, and the size of data stored can be ample, this data can be updated and automatically processed and stored. In contrast, the simplest tags are more expensive than a printed barcode, also external influences such as metalwork, material dielectric properties and radio interference can constrain RFID remote reading.

RFID technology has overwhelmed the business world because of its simplicity, economy, and compactness. In the hospital setting, RFID data can be used in an unlimited number of useful applications such as locating and tracking medical staff, patients, medical supplies and equipment. This allows improved patient safety standards and medical services at lower cost. This project develops an RFID-based hospital Positioning System that manages the collection, processing, and analysis of location data based on RFID infrastructure.

**Project Title: Design and implementation of online secure data and Voice integrated system**

**Project Start Date:** March, 2009

**Project End Date:** June, 2010

**ITAC Fund:** 750,000 EGP

**Industrial Partner:** National Telecommunication Institute (NTI) Electronics and Communication

**Industrial Partner Contact Person:** Dr. Ahmed El-Sherbiny

**PI Name:** Dr. Iman Ashour

**Academic Partner:** National Telecommunication Institute (NTI) Electronics and Communication

**Project in brief:**

In recent years the importance of security in information technology has increased significantly. To guarantee confidentiality and authenticity of information cryptographic algorithms and methods are used. There are software- and hardware-oriented algorithms, which are well suitable for both implementation forms.

This project aims to study, design, and implement an integrated on line secure voice and data system using a standard encryption/decryption algorithm hardware design based on reconfigurable VLSI technology to enable the end user to implement its own hardware encryption/decryption algorithm to meet its requirements. A prototype of the overall system including hardware design of a standard encryption/decryption algorithm (AES), system control, synchronization, and interfacing modules will be tested on public switch telephone networks (PSTN).

**Project Title: Hardware-Software Massively Parallel Full Precision Analog Simulation Engine**

**Project Start Date:** March 1, 2009

**Project End Date:** August 31, 2010

**ITAC Fund:** 985,291 EGP

**Industrial Partner:** Academy Company for Communications & Information Technology (ACCIT)

**Industrial Partner Contact Person:** Dr. Amr M. Bayoumi

**PI Name:** Dr. Yasser Y. Hanafy

**Academic Partner:** Arab Academy for Science & Technology (AAST)

**Project in brief:**

The project aims to develop a massively parallel software-hardware analog simulation engine. It utilizes the new development in many-core architectures such as graphics cards or multi core processors to rewrite EDA tools in an explicit parallel form. Full precision analog simulation was taken as the first step.

Business roadmap depends on partnership with major worldwide industry players for hardware-software tools and customer leads, on early customer engagement even before the final product release in order to ensure a realistic target.

**Market Impact:**

**Present contracts/agreements:**

- Signed NDAs with several companies based in USA, (including major vertically integrated IC manufacturers) under which they have given them representative circuits to test their product.
- Agreed with one Silicon Valley-based EDA company on complementing their product portfolio, under which they can serve as their marketing and product support arm.
- Their technology partner, ATI/AMD, helps them on marketing and promoting their product.

**Published Papers related to the project:**

- *Invited article* in IEEE Magazine (*co-authored with AMD*):
- A.M. Bayoumi Michale Chu, Y. Hanafy, Patricia Harrell, and Gamal Refai-Ahmed, "Scientific and Engineering Computing using ATI Stream Technology" in the IEEE Magazine "Computing in Science and Engineering", pp. 92-97, Nov./Dec. 2009 issue.
- A.M. Bayoumi and Y. Hanafy, "Massive Parallelization of SPICE Device Model Evaluation on GPU-Based SIMD Architectures", Proceedings of the First International Forum on Next-Generation Multicore / Manycore Technologies, Cairo, Egypt, Nov.24, 2008.

### **Workshops**

A.M. Bayoumi and Y. Hanafy, "Studies with GPUs", NSF US-Egyptian Workshop on. Multicore & Heterogeneous Computing. Cairo, June 22-23, 2009. The presentation is posted on AMD's official website.

## Project Title: Quality Assurance Management system QAMS

**Project Start Date:** March, 2009

**Project End Date:** March, 2011

**ITAC Fund:** 1,000,000 EGP

**Industrial Partner:** Vertika

**Industrial Partner Contact Person:** Dr. Waleed Hamed

**PI Name:** Dr. Amr Kamel

**Academic Partner:** Faculty of Computers and Information Cairo University

### **Project in brief:**

The proposed project concerns with developing a complete product to manage the quality assurance activities in Small Medium Entities SME's developing software systems and to introduce IT services. The intended product will be developed based on a pre-developed complete product, which titled as VertiKa Quality Application (VQA). VQA is developed by VertiKa Company for managing all quality assurance activities of the company. VertiKa Company depended on VQA to deploy practices to satisfy the requirements of CMMI-L2. VQA is considered the prototype for the (Quality Assurance Management System) software detailed in this proposal.

The proposed software will be developed to manage all quality assurance "Process flow" activities of SME's based on CMMI Level 2 and Level 3 in staged representation; to cover all generic and specific goals and all sub-practices. The proposed software will be developed with features to support the SME's going across CMMI appraisals activities "with all its levels". It will support the SME's to generate the required Practice Implementation Indicator Description PIID. It will support, also, the automatic generation of readiness review report. Beside all of that, the proposed software will produce the gap analysis results against the CMMI model based on SCAMPI C.

# PDP On-Going Projects

### Project Title: Development of a PC-Based High-End 4D Ultrasound Imaging System

**Project Start Date:** August, 2009

**Project End Date:** June, 2010

**ITAC Fund:** 2,704,000 EGP

**Industrial Partner:** International Biomedical Engineering Technologies Bahgat Group

### Project Title: Clear Vision, Interactive Visualization Tools For Business Intelligence

**Project Start Date:** September, 2008

**Project End Date:** February, 2010

**ITAC Fund:** 250,000 EGP

**Industrial Partner:** Microtech

**Industrial Partner Contact Person:** Eng. Magdy Elsharkawy

**PI Name:** Dr. Mohamed Saad Ghoneim

**Academic Partner:** French University

#### **Project in brief:**

Clear Vision aims to provide advanced interactive visualization tools to support the decision making process in the Business Intelligence realm.

This project capitalizes on the lessons and insights gathered within the Information Visualization research field over the past 20 years, as well as the deep understanding of businesses and their needs crystallized over two decades by a major ERP solution player in the Middle East. The project's tools will provide next generation Business Intelligence allowing interactive exploratory visualization of huge datasets, and effective communication of findings, through advanced yet easy-to-use visualization tailored to meet well-identified requirements of Business Intelligence tasks, covering Stock Management, Asset Management, Financial Data such as account payables and retail market data.

**Project Title: Development of a PC-Based High-End 4D Ultrasound Imaging System**

**Project Start Date:** December, 2009

**Project End Date:** December, 2010

**ITAC Fund:** 2,704,000 EGP

**Industrial Partner:** International Biomedical Engineering Technologies Bahgat Group

**Industrial Partner Contact Person:** Dr.Abo bakr Abdelfatah

**PI Name:** Dr. Yasser Kadah

**Academic Partner:** Faculty of Engineering Cairo University

**Project in brief:**

Project proposes to develop an affordable high-end four-dimensional (4D) ultrasound imaging system based on a personal computer (PC). The target product includes Doppler ultrasound, color flow mapping, sensor-based 3D imaging, 4D imaging, and bone mineral densitometry all integrated within the same system in such a way to allow modularity.

It allows also new features to be integrated into the same system to share the same hardware such as ultrasonic bone mineral densitometry, which is very expensive as a stand-alone product while being an important tool for the clinicians to diagnose osteoporosis in women.

**Project Title: Ultra Low Power Bluetooth Transceiver Chip**

**Project Start Date:** August 1, 2009

**Project End Date** June 30, 2012

**ITAC Fund:** 1,580,000 EGP

**Industrial Partner:** Silicon Vision

**Industrial Partner Contact Person:** Eng. Tarek El Esseily

**PI Name:** Dr. Yehia Ismail

**Academic Partner:** Nile University

**Project in brief:**

The objective of this project is to design, prototype and produce a commercial ultra low power wireless communications chip. The chip will be based on the Ultra Low Power (ULP) Bluetooth standard initially developed by Nokia and later adopted by the Bluetooth SIG consortium. This standard offers a dual mode chip and the low cost single mode chip targeted by this proposal. The chip is expected to be ubiquitously deployed in various consumer products such as watches, Human Interface devices (HID), toys, remote controls, medical equipment and automotives to name a few. The expected market for the single mode chips is expected to be more than 15 Million chips in 2012 primarily in the Far-East, where manufacturers of consumer products will be mainly looking for high volume and low cost chips.

**Market Impact:**

**Present contracts:**

- Silicon Vision marketing front in USA addressed the tier-1 customer US customer.
- The tier-1 customer, technical & marketing representatives visited Silicon Vision premises in Egypt December 2010 to conduct business meetings.
- Silicon Vision team showed the customer a life demo for an RF transceiver chip that was designed by the team for a different standard (1.0 GHz), to increase the customer confidence level in the team capabilities in the RF design field.
- The customer requested to have samples from the chip maximum by mid 2011 and they are ready to issue PO for the samples by end of Q2 2011 for evaluation.
- The customer is ready to issue production PO for the final chips by Q4 2011.
- A feasibility study contract with the US customer has been signed to study the feasibility of the product and to put down the production plans.

## Project Title: A Product for Arabic Optical Character Recognition

**Project Start Date:** May, 2010

**Project End Date:** May, 2011

**ITAC Fund:** 1,239,350 EGP

**Industrial Partner:** RDI

**Industrial Partner Contact Person:** Eng. Abdelrahman Mohsen Rashwan

**PI Name:** Dr. Mohsen Rashwan

**Academic Partner:** Faculty of Engineering Cairo University

### **Project in brief:**

The targeted product is a reliable highly-performing Arabic omni font-written OCR software system. This software takes scanned Arabic paper documents as its input, and automatically produces the digital files corresponding to them as if a typist has edited those paper documents on a digital computer. Such a software is not new in principle. In fact, OCR systems are being developed since decades, tens of research Arabic OCR pilots have been produced by the academia<sup>1</sup>, and some Arabic OCR products are even available in the market! See section E below on Market/Competitive analysis. However, a reliable Arabic OCR software that works on real-life (multi-font, multi-size, maybe noisy, ...) documents at a practically acceptable average word-error-rate (WER within 3%) is yet away from being available in the market. This is what we produce in this proposed project using a new proven technology based on theoretical foundations similar to those deployed in digital speech recognition systems. Document management systems (DMS), libraries digitization, information retrieval (IR), uni/multi modal text entry, reading assists for the blind, .. etc., are just examples of software systems that may benefit from our OCR. Moreover, our Arabic OCR software may serve other languages using Arabic script like Persian, Urdu, .., etc. A full-fledged pilot system has been built. In this system; hidden Markov models (HMM) is used as the recognition tool, autonomously normalized horizontal differentials has been invented as the recognition feature, and a new algorithm for lines & words decomposition algorithm is designed. This pilot has shown excellent results when tried on numerous documents containing multiple fonts and sizes. In fact, these results are the best reported ones in the published literature to date regarding omni font-written OCR.

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## Project Title: MEMS Based Timing Chips for IT/Mobile Applications

**Project Start Date:** September, 2010      **Project End Date:** February, 2013

**ITAC Fund:** 2,999,999 EGP

**Industrial Partner:** MEMS Vision LLC

**Industrial Partner Contact Person:** Dr. Mourad Elgammal

**PI Name:** Dr.Hany Fikry

**Academic Partner:** Faculty of Engineering Ain Shams University

### **Project in brief:**

The objective of this project is to design, develop, and bring to production level commercial timing reference chips which are highly miniaturized, programmable, and very competitive in terms of performance and cost. The core technologies of these products are state-of-the-art micro-electromechanical devices (MEMS), and highly integrated circuitry.

Highly miniaturized timing chips will be an enabling technology at the heart of next generation cutting-edge electronic products, especially mobile devices, computing equipment, graphics cards, disk drives, and high capacity SIM cards, just to name a few. MEMS based timing solutions are starting to gain a share of the global multi-billion crystal and timing chips markets, with an anticipated high growth over the next years.

Developing and establishing the know-how and the industry of micro/nano technologies in Egypt and in the region is very important. These are considered state-of-the-art platform technologies which, once in place, will certainly support further ICT industries, markets, and applications in Egypt far beyond those targeted here, thus significantly contributing to the local economy through the potential increase in the associated capital investment. Also, the establishment of this technology in Egypt will encourage/support further collaborations with international partners.

A fully functional prototype has been successfully developed and characterized, based on many years of research and development. Based on the IP that resulted from the earlier prototyping exercise, the knowhow gained, and the patents portfolio that was developed, the aim of this project is to transform our prototype MEMS based timing chips into a commercial grade product.

In order to achieve the goals above, both industrial engineering developments and additional R&D are needed. On the engineering side, all of the prototype sub-systems need to be elevated to commercial/production grades, either through augmenting them with features which were not included during prototyping (e.g. compensation over battery voltage level variations), or by redesigning them to target specific industry standards (e.g. emerging USB standards). On the R&D side, advanced chip calibration and compensation algorithms need to be developed and incorporated into the final product, in order to ensure its reliability and robustness under the expected operating conditions (e.g. temperatures from -20 °C to 70 °C). This is a critical component of the system, and will be jointly pursued by the university and industrial teams.

Throughout the R&D phases to be pursued here, a major objective will be to optimize the overall system to maximize performance but also, very importantly, to minimize full production cost in order to be very competitive on global markets. For example, in the IC business, reducing the area of the integrated electronics directly translates into a reduction in cost, and thus price.

In addition to the electronics, our proprietary MEMS technology needs to be transferred under NDA to a commercial foundry, in preparation for volume production. Inevitably, this will require further process R&D in terms of process adaptation and devices optimizations.

Finally, executing a good and sound marketing plan is an important aspect in the success of any commercialization activity, especially when the product is a very high-tech one. We will pursue a well defined marketing plan early on in this project, and throughout, with the aim of involving potential customers and partners during the development phase as needed, and line them and other customers up once product samples are ready for evaluation.

## Project Title: Crystal-Less LC-Based Reference Clock

**Project Start Date:** February, 2010

**Project End Date:** January, 2012

**ITAC Fund:** 2,732,500 EGP

**Industrial Partner:** SI-Ware

**Industrial Partner Contact Person:** Eng.Ayman Refaat

**PI Name:** Dr. Khaled Sharaf

**Academic Partner:** Faculty of Engineering Ainshams University

### **Project in brief:**

Most modern communication systems require several reference clocks to operate and interface with other equipment. This involves employment of several quartz crystal components which are relatively costly and consume bigger volume since they cannot be integrated on-chip.

For several decades, many companies and start-ups have been trying to develop crystal-free clock oscillators with competitive performance. Although some of these companies have succeeded in eliminating quartz crystals, they have not succeeded to achieve adequate levels of performance.

Si-Ware has developed an LC-based oscillator which replaces the quartz crystal with a simple low cost on-chip LC-tank. A revolutionary Self-Compensated Oscillator (SCO) concept has been introduced by Si-Ware. This new type of oscillator has by design a very low temperature sensitivity thus allowing performance better than  $\pm 100$ ppm across the commercial and extended commercial temperature ranges. In the last couple of years, Si-Ware has developed two chips acting as a proof-of-concept and a prototype for the proposed technology. Both chips have been fully characterized and tested. The proof-of-concept chip has validated the innovative SCO concept and other related design techniques. The prototype chip has provided Si-Ware with a deeper insight and understanding of the technology, related issues and problems. Efforts during the next stage will focus on performance optimization and placing the prototype in a form that is much closer to the final product requirements and specifications.

In parallel to development efforts, Si-Ware has hired a professional marketing consultant in the US to conduct competitive analysis and to develop a full product definition and roadmap. The proposal summarizes results of such analysis which concludes that our LC-tank based oscillator is the most competitive solution in the very high volume low-medium performance timing clock market. The proposal presents a comprehensive plan to complete the development of this novel product and reach a fully qualified industrial prototype ready for manufacturing and commercialization.

This product is expected to be sold in very high volume once reaching full production and can boost the exports of the ICT industry by **150 MLE** in Egypt

# New PDP Projects

## Project Title: Commercialization of Decimal HW Acceleration Technology for Greener Financial Computation

**ITAC Fund:** 2,751,200 EGP

**Industrial Partner:** Silminds

**Industrial Partner Contact Person:** Eng. Mostafa Elkhoully

**PI Name:** Dr. Hossam Fahmy

**Academic Partner:** Faculty of Engineering Cairo University

### **Project in brief:**

Ten is the natural number base or radix for humans resulting in a decimal number system while a binary system is natural to computers. Simple decimal fractions such as  $1/10$  (which might represent a tax amount or a sales discount) yield an infinitely recurring fractional number if converted to a binary representation. Hence, a binary number system with a finite number of bits cannot accurately represent such fractions. When an approximated representation is used in a series of computations, the final result may deviate from the correct result expected by a human and required by the law [1], [2]. One study [3] shows that in a large billing application such an error may be up to \$5 million per year. Banking, billing, and other financial applications use decimal extensively. Such applications may rely on a low level decimal software library or use dedicated hardware circuits to perform the basic decimal arithmetic operations. A benchmarking study [4] estimates that many financial applications spend over 75% of their execution time in Decimal Floating Point (DFP) functions. For this class of applications, the speedup resulting from the use of a fast hardware implementation (such as our prototype system) versus a pure software implementation ranges from a factor of 5.3 to a factor of 31.2 depending on the specific application running. Although the speed of calculation is important for financial data centers but there is an even more important issue: energy. Our patent pending technology was used to discuss and measure the energy savings in Decimal Floating Point (DFP) hardware units. Our team was the first in the world to point to the importance of energy savings and we were invited to present the emerging decimal industry along with IBM and Intel at the top international conference in the field [5]. SilMinds and IBM are the only companies in the world with decimal hardware while Intel has a dedicated SW library running on their processors. We were also the first in the world to present a hardware implementation of a DFP fused multiply-add [6]. On average, our prototype hardware gives an improvement in energy-delay product of over 500 versus a pure software solution. For a mid-size data center (such as those used for billing in telecommunication operators in Egypt) this may translate to over half a million US dollars of savings per year. We are currently continuing the development of our various decimal cores and starting the first steps of productization under a grant from the European Union through the RDI program with an approximate budget 360000 Euros or about two and a half million EGP. In this proposal, we intend to continue on our fruitful joint research to move the prototypes to products and develop different acceleration cards that suit the different needs of various customers. In order to commercialize these products we have to conduct several marketing activities that lead us to establish business partnerships. The fund through ITAC is crucial to enable our team to continue its

leadership of this research field in the world. The fund is a critical element to strengthen the leadership position of an Egyptian company in this new decimal market.

[1] M. F. Cowlshaw, "Decimal floating-point: algorism for computers," in 16th IEEE Symposium on Computer

Arithmetic: ARITH-16 2003: proceedings: Santiago de Compostela, Spain, 15–18 June, 2003.

[2] European Commission, The Introduction of the Euro and the Rounding of Currency Amounts, European Commission Directorate General II Economic and Financial Affairs, Brussels, Belgium, 1997.

[3] M. F. Cowlshaw, "The 'telco' benchmark," World-Wide Web document., Hursley, UK, 2002. [Online]. Available:

<http://speleotrove.com/decimal/telco.html>

[4] L.-K. Wang, C. Tsen, M. J. Schulte, and D. Jhalani, "Benchmarks and performance analysis of decimal floating-point applications," IEEE, pp. 164–170, 2007.

[5] H. A. H. Fahmy, R. Raafat, A. M. Abdel-Majeed, R. Samy, T. ElDeeb, Y. Farouk, "Energy and Delay Improvement via Decimal Floating Point Units", in 19th IEEE Symposium on Computer Arithmetic: ARITH-19 2009: proceedings: Portland, Oregon, USA, June, 2009.

[6] R. Samy, H. A. H. Fahmy, R. Raafat, A. M. Abdel-Majeed, T. ElDeeb, Y. Farouk, "Decimal Floating Point Fused-Multiply-Add Unit", 53rd IEEE MidWest Symposium on Circuits and Systems, Seattle, Washington, USA, Aug. 2010.

# Completed ARP Projects

**Project Title: Instructional video content searching indexing through audio signal analysis with Arabic language support**

**Project Start Date:** July, 2007

**Project End Date:** February, 2009

**ITAC Fund:** 228,500 EGP

**PI Name:** Dr. Mohamed Hesham Farouk

**Academic Partner:** Faculty of Engineering Cairo University

**Project in brief:**

The objective of this research is the design and implementation of a software utility for searching and indexing of e-learning video contents. The searching and indexing facility will be implemented through the extracted cues obtained from the associated audio signal contained in the learning video recordings. This approach will ensure simpler, faster and more economic accessibility of the e-learning course with more user-independence. Till now, this objective is still the subject of many recent research publications and projects. More enhancements can be added to this work by adding an Arabic language support.

**Project Title: Medical diagnosis system for endemic using self organizing data mining technology**

**Project Start Date:** July, 2007

**Project End Date:** November, 2008

**ITAC Fund:** 174,325 EGP

**PI Name:** Dr. Marghany Hassan

**Academic Partner:** Faculty of Computers and Information Assuit University

**Project in brief:**

The project aims to build a medical diagnosis system that could effectively identify common/residential disease in Egypt, a set of cases that are already diagnosed from Egyptian hospitals will be collected to train the system, after organizing the data in the proper way and selecting the most judging attributes with the help of medical advisor, data mining analytical tools will be our way to identify the disease. The research would produce an effective clinical medical diagnosis system for the most common residential diseases.

## Project Title: Gray Images and Movies Computer Based Coloring

**Project Start Date:** April, 2008

**Project End Date:** February, 2009

**ITAC Fund:** 144,000 EGP

**PI Name:** Dr. Mohee Hadhoud

**Academic Partner:** Faculty of Computers and Information Menoufia University

### **Project in brief:**

The trend for coloring gray scale mages and movies becomes very interesting research point nowadays since it is utilized to increase the visual appeal of images such as old black and white photos, movies or scientific illustrations. The trend for automatic computer based coloring is an important goal for many researchers in this field.

The project proposes a new system for automatic gray image coloring. The proposed system is constructed as a texture based recognition system that recognize the objects in textural images like natural scenes, and then retrieve their actual colors from a previous knowledge on their classes. This procedure is a trial of simulating the human vision in this area.

## Project Title: A Design Assistant System For Architects

**Project Start Date:** September, 2008

**Project End Date:** January, 2010

**ITAC Fund:** 245,430 EGP

**PI Name:** Dr. Dina Taha

**Academic Partner:** Faculty of Engineering Alexandria University

### **Project in brief:**

The main objective of the research is to develop an intelligent software product that would aid architects both in practical and educational fields. This would be achieved in the following fields:

1. Industry: reducing the amount of time an architect spends on searching and retrieving prior designs relevant to the current design problem.
2. Education: helping architecture students by providing them with a diverse collection of designs by different architects working within different environments.
3. Research: developing new machine learning techniques that are suitable for the context of architectural design.

**Project Title: Valuable Discovery from Hyper Spectral Images**

**Project Start Date:** March, 2009

**Project End Date:** February, 2010

**ITAC Fund:** 450,000 EGP

**Industrial Partner:** National Authority for Remote Sensing and Space Sciences

**Industrial Partner Contact Person:** Dr. Ayman Eldessouki

**PI Name:** Dr. Ibrahim Imam

**Academic Partner:** Arab Academy for Sciences & Technology, Faculty of Computers

**Project in brief:**

The project objective is to identify the total area cultivated by a certain crop. This project aims at providing the structure of a system for evaluating the total area cultivated with wheat in Egypt during a specific season and hence give as estimate for the national wheat productivity during that season. Moreover, such system will be tested on a pilot area cultivated with wheat within Egypt. The project will involve the development of the local database of the spectral signature for the wheat crop in Egypt, and uses that database for assessment of the productivity of the wheat crop during a season.

## Project Title: Design and Implementation of DVB-T Solution

**Project Start Date:** December, 2009

**Project End Date:** October, 2010

**ITAC Fund:** 500,000 EGP

**Industrial Partner:** Varkon Semiconductors, A subsidiary of Varkon Group

**Industrial Partner Contact Person:** Eng. Ahmed Eloteify

**PI Name:** Dr. Ahmed Shalash

**Academic Partner:** Faculty of Engineering Cairo University

### **Project in brief:**

Currently, televised broadcasts in Egypt, and most other countries, are still analog. TV receiver sets for the traditional analog broadcasts are readily available. The transition to digital broadcasts, compliant with DVB-T standard is scheduled in many of these countries. Hence, there is already a growing market for digital receivers for this type of broadcast. Also, adopting digital TV receivers for mobile devices is creating an even bigger market opportunity.

The ultimate aim of this project is to provide an inexpensive solution for a DVB-T receiver chip, catering for mobile users as well as stationary users. Although DVB-T was not specified for mobile applications, the challenge remains to make the proposed design take mobile users, and hence mobile channel effects into account.

**Project Title: A Proposal for Designing a Computer Aided Detection (CAD) System for Breast Cancer Detection in Egypt**

**Project Start Date:** March, 2010

**Project End Date:** March, 2011

**ITAC Fund:** 367,500 EGP

**Industrial Partner:** MESC for Research & Development

**Industrial Partner Contact Person:** Mr. Haytham Zakareya

**PI Name:** Dr. Waleed Youssef

**Academic Partner:** Faculty of Computers and Information Helwan University

**Approved Time Extension:** 2 months

**Project in brief:**

According to the Egyptian National Cancer Institute, breast cancer is ranked as the most common cancer site among females in Egypt. Increased awareness has been paid towards the problem; a national campaign has been launched to establish a screening program for early detection. The American Food and Drug Administration (FDA) had approved the use of Computer Aided Devices (Detection or Diagnosis) (CAD) in 1998; since then many CAD systems have been developed, particularly in the U.S. However, CAD systems do not exist in Egyptian laboratories for their exaggerated cost. The relative number of breast cancer incidences among other types of cancer, the absence of CAD systems in the Egyptian labs, the high cost of the available systems in the market, all along with the current governmental awareness cast the problem of designing our own CAD system as imminent. The current project aims at designing CAD software that “aids” mammographers in classifying suspicious breast masses as tumors or non-tumors. The research activities include CAD literature reviewing, mammograms collection from Egyptian laboratories, image processing and machine learning algorithms design, software engineering (SWE) activities for producing end-user software, and clinical trials to measure the relative performance of radiologists before/after using the CAD.

# ARP On-Going Projects

**Project Title: Design and implementation of the Physical layer of the long Term Evolution Mobile Communication system with beam forming Antenna System**

**Project Start Date:** December, 2009

**Project End Date:** May, 2011

**ITAC Fund:** 500,000 EGP

**Industrial Partner:** Pyramid Tech

**Industrial Partner Contact Person:** Dr. Ahmed Abdelrahman Abo-Ouf

**PI Name:** Dr. Essam Sourour

**Academic Partner:** Faculty of Engineering Alexandria University

**Project in brief:**

Wireless networks continue to develop at a steady rate. Every day, mobile networks support new services at multi-megabit rates. One of the radio access technologies enabling these networks is the Long Term Evolution of Universal Terrestrial Radio Access Network (LTE).

The main objective of this ARP proposal is to develop the Physical Downlink Shared Channel (PDSCH) of the LTE and perform real-time high-speed prototype demonstration on a DSP+FPGA Software Defined Radio board. One challenging objective of this proposal, which makes it unique, is the development and design of additional processing blocks that add beamforming capabilities to the PDSCH.

The project aim in this proposal is thus three-fold. The first is designing and developing the basic PDSCH described earlier. The second is porting the developed codes into a software defined radio hardware platform prototype. The third is developing beamforming algorithms and implementing them on the SDR platform.

## Project Title: A State -of-the-art Fully Distributed Arabic Search Engine

**Project Start Date:** December, 2009

**Project End Date:** May, 2011

**ITAC Fund:** 500,000 EGP

**Industrial Partner:** COLTEC Corporation

**Industrial Partner Contact Person:** Dr. Tagrid Anber

**PI Name:** Dr. Mohamed Abdeen

**Academic Partner:** Faculty of computers and Information Ainshams University

### **Project in brief:**

The goal of this project is to build a feature rich, fully distributed Arabic search engine that is properly tailored to suit the special nature of the Arabic language with the main goal in mind to provide the needed support for the Arabic community to strengthen the multilateral relationships between its countries. The project research has shown that the currently popular search engines that have Arabic support, such as "Google", do not consider properly the nature of the Arabic language, consequently, the search results are always of low precision and recall.

The project target is to develop a fully distributed Arabic search engine of comparable efficiency to popular English search engines (such as Google). The core of the proposed Arabic search engine is based on linguistic processing in both indexing and querying, which guarantees accurate and comprehensive search results with minimal redundancy.

## Project Title: Online Hand writing Arabic Character Recognition

**Project Start Date:** December, 2009

**Project End Date:** December, 2010

**ITAC Fund:** 498,400 EGP

**Industrial Partner:** Gama Technology

**Industrial Partner Contact Person:** Dr. Mostafa Elsayed

**PI Name:** Dr. Khaled Mostafa Elsayed

**Academic Partner:** Faculty of Computers and Information Cairo University

### **Project in brief:**

The objective of this project is to develop a robust system for online handwriting Arabic character recognition that can be used for tablet PCs, and PDAs that support windows platform. A preprocessing algorithm will be applied on the input strokes for smoothing and gap filling. Two approaches will be explored for recognition; segmentation before recognition and segmentation during recognition. A set of features will be extracted from the input shapes and stroke directions, in addition to some geometric features in order to build feature vectors for input part of Arabic words (PAWS). Each writer will build his own profile using features extracted from his training samples. This profile will be used during recognition phase. Multiple classifiers (such as Neural Network, HMM, and statistical classifiers) will be explored to choose the most suitable from both accuracy and speed points of view.

Since there is no Standard Arabic Handwriting Training Dataset, samples will be collected from writers to construct both training and testing datasets. Test data size will be 1000 words (this should cover Arabic Characters, Numerals, Part of Arabic words (PAWs), and full Arabic words). The target of this project is to achieve 90% character recognition rate accuracy.

**Project Title: IBIM: Infrastructure bridges Information Modeling**

**Project Start Date:** December, 2009

**Project End Date:** December, 2011

**ITAC Fund:** 493,635 EGP

**Industrial Partner:** BIM Engineering Solutions

**Industrial Partner Contact Person:** Eng. Sabry Ismail

**PI Name:** Dr. Mohamed Mahdy Marzouk

**Academic Partner:** Nile University

### **Project in brief:**

The primary goal of the proposed project is to conceive and develop a unique and innovative Infrastructure Bridges Information Modeling (IBIM). To this end, the four main research objectives of this project are to: (1) develop an easy-to-use 3D modeling approach that simplifies exploration, navigation, and analysis; (2) formulate an advanced estimating system that allows users to produce faster and more accurate cost estimates, reports, and bids; (3) provide a scheduling tool that automatically generate multiple project schedules based on customized scheduling logic, and (4) provide a repository of bridge construction knowledge that can be reused in future projects after incorporating the feedback of the various stakeholders after projects execution. The overall development will form 5D modeling of construction projects (3D+time+cost) which will be used to communicate and integrate construction supply chain.

## **Project Title: An Innovative Hotel Revenue Management System**

**Project Start Date:** May, 2010

**Project End Date:** May, 2012

**ITAC Fund:** 498,240 EGP

**Industrial Partner:** Comsys Software - DMCM Center of Excellence - Faculty of Computers and Information, Cairo University

**Industrial Partner Contact Person:** Eng. Yasser Kadry

**PI Name:** Dr. Mohamed Mostafa Saleh

**Academic Partner:** Faculty of Computers and Information Cairo University

### **Project in brief:**

The project aims to develop a prototype for a hotel revenue management system. Revenue management is the science of dynamically controlling the price and quantity offered in a way to maximize revenue. Revenue management is particularly effective for hotels and can lead to significant revenue enhancement. The project is collaboration between the Cross-Industry Data Mining Track of the Data Mining and Computer Modeling (DMCM) Center of Excellence and Comsys Software Corporation (the leading company in Egypt in the hotel management IT solution market). The team has developed a novel proof of concept for a revenue management system. The proposed proof of concept uses aspects of stochastic modeling, Monte Carlo simulation, and optimization theory. The prototype to be produced would eventually complement Comsys Software's hotel management system, and therefore this is expected to strengthen its competitiveness.

## Project Title: TraffiSense an Integrated Visual Sensing System for Advanced Traffic Management

**Project Start Date:** October, 2010

**Project End Date:** October, 2012

**ITAC Fund:** 985,110 EGP

**Industrial Partner:** INOTEK System

**Industrial Partner Contact Person:** Eng. Wael Hossam

**PI Name:** Dr. Mohamed Elhelw

**Academic Partner:** Nile University

### **Project in brief:**

Prolonged daily periods of road traffic congestion waste time, money, and degrade both the environment and our quality of life. In Egypt, the problem is significant with severe traffic delays and high accident rates leading to devastating effects on the economic growth and challenging any progression towards sustainable development. Conventional traffic management strategies have traditionally focused on the expansion of the transportation network capacity such as building new highways and bridges. Capacity expansion, however, failed to keep pace with sharp increases in demand, resulting in widely spreading congestion and raising concerns about the long-term sustainability of this approach. As advances in information and communications technologies continue to revolutionize all aspects of our lives, real-time control of our traffic network becomes more viable. The implementation of such systems is steadily becoming a reality that will reshape the way people, vehicles, and roads interact through technology. The TraffiSense project aims at developing advanced information and communications technologies in order to provide an integrated system for road traffic management. The proposed system will facilitate the key traffic management tasks of (a) traffic network monitoring to sense and enumerate the activities of vehicles and detect law violations; (b) transformation of raw traffic data into useful information such as congestion levels and traffic stream parameters; and (c) provision of real-time traffic information to traffic management and law enforcement authorities as well as traffic network commercial end users. To achieve its vision, TraffiSense will be developing and advancing the state of the art in areas of wireless embedded systems, computer vision and intelligent transportation systems. Specifically, the development part of the project will have three key technical activities. First, development of smart traffic sensor hardware platform and embedded firmware/middleware. The traffic sensor will feature low-power components and small form factor hence complying with the requirements for green computing through energy efficiency and lowered electrical and magnetic emissions. Second, creation of compact computer vision algorithms for on-node acquisition and processing of visual traffic data. Third, development of a traffic information engine for transformation of raw data into usable traffic information. For traffic information provision, web-based TraffiSense front-end system interface and tools will be created. Furthermore, a functional prototype will be deployed at a selected road intersection in Cairo to demonstrate the applicability and practical value of the proposed system in traffic management operations. The business opportunity of marketing and selling the new system is enormous as most of the current traffic management systems are expensive to acquire and operate, and invasive to deploy. TraffiSense will be a pioneering product

that combines the use of smart visual sensing and intelligent transportation techniques for inexpensive deployment and autonomous operation. The project will address a number of innovative research issues such as vehicle and pedestrian detection and segmentation, distributed vehicle classification using resource-constrained smart sensor nodes, and transformation of raw traffic data into useful traffic flow parameters and characteristics. The successful execution of the project will result in (1) sensory devices that can be easily deployed, and (2) a functional integrated traffic management system prototype; both complement each other but can be marketed separately. Another key outcome is advancing state of the art technologies in the field of smart visual sensing, which will form the basis for many commercial applications in other areas such as of critical infrastructure surveillance, security, advanced healthcare delivery, search and rescue, sports and media, just to name a few.

## Project Title: Sentiment Analysis and Opinion Mining of the Arabic Web (Digital Content)

**Project Start Date:** January, 2011

**Project End Date:** December, 2012

**ITAC Fund:** 794,200 EGP

**Industrial Partner:** OT Venture (Link Dev.)

**Industrial Partner Contact Person:** Eng. Hanan Abdelmeguid

**PI Name:** Dr. Ahmed Rafea

**Academic Partner:** AUC

### **Project in brief:**

With the tremendous spread of social networks and blogs<sup>2</sup>, the Internet has become the most frequently-used medium for exchange of information and opinions. Accordingly, the mining of such opinions using news articles, product reviews, and blogs has created a natural opinion gauge for online users. The need for Sentiment Analysis tools that can, semantically understand such opinions, rather than just extract them, has become inevitable. Such tools can help in many aspects of the business world, such as allowing companies to know what customers think of an upcoming product and act accordingly. Although many sentiment analysis applications have emerged, most of these are specific for the English language and cannot be generalized to other languages. Introducing an Arabic version of such tools could be of great demand in the Arabic IT World, especially in the current years where the Arabic internet has experienced an unprecedented growth percentage. Due to the complicated nature of the Arabic language, the possibility of developing such an application is a quite challenging task. As part of its continuous contribution to the Arabic IT World, LINK Development proposes a **Sentiment Analysis Tool (SATA)** for the **Arabic** language - based on **Semantic** extraction of **Arabic Concepts**. The tool is to act as a reflector of the feelings of Arabic users online with regards to popular topics. Despite the many challenges of the project, providing such an application can be of high value to the Arabic IT market, due to its innovative and unexplored nature.

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## Project Title: Prototyping Metamaterial Antennas

**Project Start Date:** September, 2010

**Project End Date:** February, 2012

**ITAC Fund:** 799,290 EGP

**Industrial Partner:** Elnady Company

**Industrial Partner Contact Person:** Dr. Tamer Elnady

**PI Name:** Dr. Amr Safwat

**Academic Partner:** Faculty of Engineering Ainshams University

### **Project in brief:**

The aim of this proposal is to prototype metamaterial antennas that meet both the electrical and mechanical industrial specifications. The research will rely heavily on the following two papers by the PI: "High impedance wire," IEEE Antennas and Wireless Propagation Letters, vol. 6, pp. 631 – 634, Dec. 2007 and "Microstrip coupled line composite right/left-handed unit cell," IEEE Microwave and Wireless Components letters, vol. 19, no. 7, pp. 434 – 436, July 2009. The last one was a direct outcome of the ITAC fellowship. The antennas industry is a huge one, and it has several applications. To achieve the project objectives, the team is formed from 6 researchers (PI + 2 researchers A and 3 researchers B) from Ain Shams University, Cairo University, and Elnady Engineering and Agencies. Collectively, they have both electrical and mechanical experiences. The project will start by investigating the current and possible implementation of industrial metamaterial antennas. Accordingly, design guidelines and mechanical and electrical specifications will be determined. Excessive EM simulations and modeling will then take place to achieve competitive designs. Several trials for the implementation of the antennas hand in hand with EM simulations will dominate phase 3 of the project. This phase will include characterization and testing as well. Upon the successful outcome of this phase, the antennas of a specific application will be replaced by their developed counterparts. The performance of the transceiver under test will be assessed.

**Project Title: Kids Stories Teller e-Reader ALRAWY**

**Project Start Date:** January, 2011

**Project End Date:** January, 2012

**ITAC Fund:** 999,686 EGP

**Industrial Partner:** Bluecom

**Industrial Partner Contact Person:** Eng. Amr Nabil

**PI Name:** Dr. Mohamed Shaalan

**Academic Partner:** Faculty of Engineering Ainshams University

**Project in brief:**

This project aims to develop a prototype of a new product based on the innovation of mixing both contents and mobility (anywhere, at anytime for any person) in one product. This product as e-Reader for the kid's stories (e-Content) is using the Arabic language (Text & Voice) as main to support local market and the Arabic region, with options of other languages such as English, French and German for Europe and USA penetration. This is the first time we will address the e-stories for kids in Arabic (Text and Voice) in our region.

The Product prototype that we will get out of this project is a complete e-content system where we will develop the child stories portal that can be accessed from any PC based on the security and membership protocol we will implement. The main advantage that the kids' stories will be available in Text and Voice not only in Arabic Language but in other languages as mentioned before. The contents mobility will achieved using the e-readers (Handheld) that the child can easily download all what he needs from stories selected and go way spending his time later on the mobility reading.

## Project Title: Information Theoretic Cyber Security for Emerging Wireless Networks

**Project Start Date:** January, 2011

**Project End Date:** January, 2012

**ITAC Fund:** 1,000,000 EGP

**Industrial Partner:** Smartec Group

**Industrial Partner Contact Person:** Dr. Mohamed Khairy

**PI Name:** Dr. Hesham Elgammal

**Academic Partner:** Nile University

### **Project in brief:**

This proposal describes a novel technology for wireless cybersecurity which exploits the properties of the wireless channel to construct low complexity and provable security protocols. This paradigm is rigorously rooted in an information theoretic foundation and enables a clean slate approach for the design of security protocols as well as the construction of efficient overlays with significant security enhancements at the expense of minimal modifications in the underlying network architecture. The proposed technology was pioneered by the Principle Investigator in his recent work on information theoretic security for wireless network. This work has laid the foundation for developing a prototype for a novel ARQ security overlay for Wi-Fi networks. In fact, our experimental result Smartec-Group Feb. 2010 Wireless Cybersecurity demonstrate the ability of our approach to defend against ALL known security attacks to Wi-Fi networks, and hence, make a security breach virtually impossible.

It is the aim of this proposal to develop a functional prototype that leverages the already existing proof of concept application for ARQ security at the client side, running Linux, and access point. The collaborative research and development plan will construct solutions that are standards compatible and, in parallel, strive to influence the next generation standards for Wi-Fi security. It is expected that the extension of this work may potentially start generating revenue from the Wi-Fi products by targeting Internet Service Providers (ISPs) and Security Management Providers (SMP).

# New ARP Projects

## Project Title: Design and Implementation of Low-cost Ladar System for Crash Avoidance

**ITAC Fund:** 349,979 EGP

**Industrial Partner:** 3DI

**Industrial Partner Contact Person:** Mrs. Sahar Elfadaly

**PI Name:** Dr. Ahmed Abo-ouf

**Academic Partner:** AUC

### **Project in brief:**

Each year, road traffic crashes lead to 50 million injuries, 1.2 million deaths, and more than \$500 billion in economic losses around the world. It is likely that, by 2020, traffic crashes will be the sixth-largest cause of death worldwide. Automakers and safety organizations are slowly shifting their focus on systems that help to avoid accidents (active safety), rather than on the systems that help to reduce the impact of an accident (passive safety.) The core for most avoidance systems used in active safety is a mix of radar, laser scanners, video cameras, and real-time intelligent embedded software systems. Vehicle manufacturers (OEMs) and suppliers are investing heavily in Active Safety Systems despite prevailing economic conditions. It is estimated that crash avoidance systems will mount to a 20-billion-dollar market by the year 2012. The objective of this project is to develop, patent, and fabricate a proof-of-concept prototype using a monolithic chip and the encompassing embedded software which are core components of a low-cost three dimensional (3D) flash laser-radar (ladar or lidar) system for crash avoidance of ground vehicles. This system is based on incoherent flash (doesn't require mechanical scanners) FM/cw ladar technology. Moreover, the proposed 3D flash ladar would generate range imagery as well as speed information both day and night since it uses its own infrared laser as a source of illumination. It can also reconstruct images of partially obscured objects. It is also rugged, compact, and does not include any mechanical or moving parts, which makes it more amenable to the harsh environment of road vehicles. In the production phase, the core of this ladar system will be implemented as a system on a chip (SoC) that is an integration of a focal plan array (FPA), a readout integrated circuit (ROIC), necessary 3D image reconstruction digital signal processing (DSP) circuitry, and an embedded crash avoidance algorithm—all encompassed on a single monolithic chip fabricated using standard silicon CMOS process. Therefore, we anticipate that our system would be in a great demand in global market for crash avoidance systems for factories, and OEMs of automakers. Upon success, this novel and unique technology will place Egypt on the map in the ever growing active safety market both for ladar sensor hardware and the required crash avoidance embedded software. In this project however, the objective is to develop a proof-of-concept prototype that will include a small format FPA and ROIC both integrated on a single chip using standard CMOS process while the image reconstruction circuitry will be implemented on low-cost field programmable gate array (FPGA) with a softcore microprocessor that implements crash avoidance embedded algorithms. There are two main challenges in this effort—first, the development of a monolithic chip using a standard CMOS process that encompasses FPA and ROIC and second, the identification of the optimal specifications of the complete system along with the crash avoidance algorithms. The proposing research team is a synergic partnership from the American University of Cairo (AUC), University of Alexandria, and high-tech Startup

Company, 3DI. The team consists of world-experts in flash lidar, laser derives, electro-optics, photo detectors, RF and analog circuit chip design, FPGA design, SoC design, computer vision algorithms, and embedded systems for ground vehicles. The research team has an excellent mix of rigorous academic, industrial, managerial, and entrepreneurial backgrounds and skills. The team has an average of 30 years of experience in academia and industry, the majority of which were in the USA.

## Project Title: Software Quality Control Automation Tool Suite (S-QCATS)

**ITAC Fund:** 999,987 EGP

**Industrial Partner:** Unisoft

**Industrial Partner Contact Person:** Mr. Assem Ibrahim

**PI Name:** Dr. Mohamed Abogabal

**Academic Partner:** Faculty of Engineering Alexandria University

### **Project in brief:**

Software Requirements Engineering and Testing remain the weakest areas in the process of software development, despite the advances that have been made over the past few decades. According to *Capgemini.com*, software testing is worldwide under-resourced in over half (55.7 %) of the Software Companies.

Small and Medium Enterprises (SMEs) gain more and more importance in the software development industry. Those SMEs, mostly, cannot afford the high end sophisticated Requirements Engineering and Testing suites. Even worst, without these tools and automation, their cost for Quality Management remains high, since these manual processes become cost and time intensive.

Empowering Software Development SMEs, to produce better software quality, is essential for the competence of the Software Development industry in Egypt. Focusing in particular on software testing; this can be done by enabling Software Development SMEs to focus their limited efforts on testing the most important aspects of their products, find defects as early as possible in the Software Development Life Cycle (SDLC), running only effective test cases, building accumulative knowledge, and finally automating their tests, hence conducting Smart Testing.

The core idea of the project is to enable Smart Testing by means of correlating Knowledge discovery on both Software and Testing repositories, and then move forward to build an advanced and optimized test automation suite; this is the approach adopted by the prototype described in this project

# Completed Fellowships

## **Project Title: Compact Front end Components For Wireless Networks**

**Project Start Date:** September, 2008

**Project End Date:** October, 2009

**ITAC Fund:** 98,000 EGP

**PI Name:** Dr. Amr Safwat

**Academic Partner:** Faculty of Engineering Ain Sham University

### **Project in brief:**

Recently, the concept of high impedance wire (HIW) was proposed by the applicant and was accepted for publication in IEEE wireless and antennas propagation letters. A HIW is one single wire that can have high reactive impedance per unit length. It is the 1D implementation of the high impedance surface, and it can be also viewed as a “soft line” as one of the implementations of the soft surface concept.

The presence of the HIW in conventional planar transmission lines (TLs ) creates a medium in which  $\mu$  may vary from very small negative values to very high positive values, depending on the operating frequency. This behavior may lead to develop devices with small size, e.g. an antennas implemented with HIW, will have higher efficiency and smaller size compared to the same antennas configuration implemented with the conventional techniques. Moreover, the understanding of the properties of the HIW may open the door for these “wires” to realize more complicated structures (multi-conductor artificial TLs or even volumetric metamaterials).

The project objectives are:

- Implement the new concept of high impedance wire in conventional front end passive devices.
- Develop compact size planar passive components on printed circuit board (filter, balun).
- Develop antennas with small size and better efficiency suitable for wireless communication.

### Project Title: Human Identification Using Signal

**Project Start Date:** September, 2008

**Project End Date:** October, 2009

**ITAC Fund:** 73,000 EGP

**PI Name:** Eng.Mohamed Medhat Tawfik

**Academic Partner:** Faculty of Engineering Assuit University

#### **Project in brief:**

The aim of this research is to achieve a robust human identification system using the human ECG signal as a biometric feature based on the Homomorphic Analysis and Wavelet Transform. Identification systems that use biometric data are becoming widely used in many fields like computer security, access control and law enforcement. Biometric feature must satisfy some conditions like Accuracy, Long-term Stability user acceptance ...etc. ECG signal analysis is a new approach in human identification as ECG signal has been proved to be unique for each person and satisfy the above mentioned conditions. The outcome of the research will be a computer program used in Human identification process using the ECG signal as a biometric feature based on the Homomorphic Analysis and Wavelet Transform.

**Project Title: Implementation of Hardware Digital Image and Video coder and decoders**

**Project Start Date:** July, 2009

**Project End Date:** October, 2010

**ITAC Fund:** 72,000 EGP

**PI Name:** Dr. Gamal Fahmy

**Academic Partner:** GUC

**Project in brief:**

The project propose is to develop and implement image and video coders and decoders in accordance with the most recent international standards in image and video compression, namely JPEG2000 and MPEG4.

This project is also aimed at introducing the topic of digital images/video as an interesting issue for the TV industry. Future expected digital television, setup boxes, and cable satellites are inevitable to dominate the media market in the next decade. Hence the evolution of digital image/video processing techniques is crucial for the engineering society to overcome this technology transition.

**Project Title: Adaptive Power Management for Portable Wireless Applications**

**Project Start Date:** December, 2009

**Project End Date:** December, 2010

**ITAC Fund:** 130,000 EGP

**PI Name:** Eng. Ahmed Salah Lashin

**Academic Partner:** Faculty of Engineering Cairo University

**Project in brief:**

In this project a novel power management solution is suggested for a radio frequency (RF) power amplifier (PA) of an arbitrary portable wireless device. The proposed converter will adapt itself dynamically (at run-time) to optimize its operation over a wide range of operating input voltages and output power and hence improve the efficiency of the RF PA while maximizing the converter's own efficiency and extending the battery life.