

Curriculum Vitae

Personal Profile

First name: Emad

Last name: Helal

Birth date: [April ,1st ,1988]

Marital status: Married

Military status: Exempted

Resides: Fourth District, First Neighborhood, El-Sheikh Zayed, Giza, Egypt.

Email: emad.helal@nriag.sci.eg, emadbadr2011@gmail.com

Phone: 00201007861967, 00201140282854



Education

Completion Date (Month, Year)	Degree	Name of University	Field	Grade/Title
Under-Graduate Education				
June, 2009	B.Sc.	Institute of Aviation Engineering and Technology (IAET), Giza, Egypt	Communication and Electronic Engineering	Distinction with honour's degree (89.83%) Fault Diagnosis of Analog Electronic Circuits
Post-Graduate Education				
Sept. 2013- Sept. 2015	Pre-Master Courses	Faculty of Engineering, Cairo University, Egypt	Computer Network Engineering	Successfully complete pre-master courses with GPA B+ (3.5/4)
May, 2017	M.Sc.	Faculty of Engineering, Cairo University, Egypt	Communication and Electronic Engineering	Energy-Efficient Spectrum Aware Clustering and Multi-Hop Routing for Cognitive Radio Sensor Networks
February, 2023	PhD	Faculty of Engineering, Minia University, Egypt	Communication and Electronic Engineering	Prototype Implementation Of A Digitizer For Earthquake Monitoring System

Work History

Institution	Period	Position
Institute of Aviation Engineering and Technology (IAET), Giza, Egypt	Oct. 2009 – July 2016	Teaching Assistant
National Research Institute of Astronomy and Geophysics (NRIAG), Seismology Department, Helwan, Cairo, Egypt	Aug. 2016 -Sep. 2023	Assistant Researcher
National Research Institute of Astronomy and Geophysics (NRIAG), Seismology Department, Helwan, Cairo, Egypt	Oct. 2023 -Present	Researcher (Full time)
Helwan University, Faculty of Engineering at Mataria, Automotive Mechatronics Department	2022-2023 (Spring) 2023-2024 (Fall)	Researcher (Part time)
Nahda University (NUB) Faculty of Engineering Electrical Engineering Department (Communication and Computer Engineering)	2023-2024	Researcher (Part time)

Teaching Experience

Teaching Experience				
#	Subject name	Education level	Department	Institution
1	Computational Intelligence	3rd	Electrical Engineering	NUB
2	Signal Analysis	2nd	Electrical Engineering	NUB
3	Embedded Systems	3rd	Electrical Engineering	NUB
4	Internet of things	4th	Electrical Engineering	NUB
5	Computer and Network Security	4th	Electrical Engineering	NUB
6	Microprocessors & Applications	2nd	Electrical Engineering	NUB
7	Embedded Systems	4th	Automotive Mechatronics Engineering	Helwan Uni.
8	Microcontroller	3rd	Automotive Mechatronics Engineering	Helwan Uni.
9	Digital Control	4th	Electronics and communications	IAET
10	Micro waves circuits	3rd	Electronics and communications	IAET
11	Measurements and Instrumentation	3rd	Electronics and communications	IAET
12	Signal Analysis	2nd	Electronics and communications	IAET
13	Signal Analysis and Systems	2nd	Electrical power	IAET
14	Introduction to Computers and Programming	Preparatory	-	IAET
15	Mathematics	2nd	Mechanical power	IAET
16	Mathematics	Preparatory	-	IAET
17	Physics II	First Year	Communications, Aeronautical, and Electrical Power	IAET

Achieved Projects

Year of the fund	Research theme	Source of the fund	Role
June 2020- June 2022	Manufacture of the prototype of a Triggered Digitizer for EarthquakeMonitoring System	Science and Technology Development Fund (STDF)	Project member

Theses Abstract

B.Sc. Project Abstract

Testing and diagnosis of electronic devices are fundamental topics for researchers and test engineering in the development and maintenance of safe and reliable complex systems. In both cases, the attention is focused on the detection of faults affecting a subsystem whose presence generally impairs the global system safety and performance

M.Sc. Abstract

In this thesis, we discuss the problem of how to cluster cognitive radio sensor nodes in a dynamic frequency environment and to route data to the sink in an energy efficient manner. Simulation results show that our approaches achieve a remarkable increase in throughput while extending the network lifetime with an energy efficient manner. The integration of Cognitive Radios (CR) and Wireless Sensor Networks (WSN) enables a new paradigm of communication, namely cognitive radio sensor networks (CRSN). Thanks to the cognitive radio capabilities, sensor nodes can avoid heavily crowded transmission bands by tuning their transmission parameters to less crowded bands. Despite improvement in spectrum utilization by dynamic spectrum access (DSA) capability, energy-efficient solutions for CRSN are required due to resource-constrained nature of CRSN inherited from WSN.

In this thesis, we discuss the problem of how to cluster cognitive radio sensor nodes in a dynamic frequency environment and to route data to the sink in an energy efficient manner. Clustering is an efficient way to decrease energy consumption. We propose the Energy-Efficient Cluster Head Selection (ECHS) approach for Cognitive Radio Sensor Networks (CRSNs). ECHS achieves energy-efficient clustering while taking into account the dynamic spectrum access nature of CRSN. ECHS is a distributed algorithm in which serving as a cluster head depends on two factors: the channel availability in the node's vicinity and the node's energy. To tackle the hot spot problem caused by the high traffic near the sink, ECHS forms many small clusters near the sink to share the forwarding load of the rest of the network. Dynamic Channel

Assignment (DCA) at the cluster heads is used to decrease the co-channel interference. We additionally propose a simple Energy-efficient multi-hop Routing protocol (ER) to evaluate the network performance from end-to-end. The ER protocol aim is to decrease the energy consumption at each hop along the path to the sink node and to hopefully decrease the total energy consumption for the whole path. ER suggests a certain priority in choosing the channels for the routing path in order to reduce the effect of channel switching on sensor nodes and to improve nodes' lifetime. Simulation results show that ECHS and ER protocols improve the network throughput and lifetime while maintaining high energy-efficiency.

PhD Abstract

In this thesis, we design and implement a digitizer for acquiring the seismic signal from three sensor components. One of the main devices in the earthquake monitoring system is the digitizer, which converts the analogue signal to a digital one. The implemented digitizer consists of several blocks, i.e., the power source, the front-end circuit, analog to digital converter (ADC), GPS receiver, and microprocessor. Three finite impulse response (FIR) filters had been used to decimate the sampling rate of the input seismic data according to user need. The prototype converts the incoming data into standard seismological MiniSEED format for easy data archiving and streaming. The data is streamed between seismic station and the main centre using SeedLink protocol over TCP/IP. This protocol ensures data transmission without any losses as long as the data still exist in the ring buffer. In addition, deep learning techniques are proposed for seismic data compression and picking.

The compression techniques will lead to an efficient use of the bandwidth assigned for the communication link between the seismic stations and the main centre. In this thesis, two convolutional auto encoders (CAEs) are proposed for seismic data compression. The two algorithms are mainly based on the convolutional neural network (CNN), which has the capability to compress the seismic data into feature representations, thereby allowing the decoder to perfectly reconstruct the input seismic data. The results show that the first model is efficient at low compression ratios (CRs), while the second model improves the signal-to-noise ratio (SNR) from about 3 dB to 12 dB compared to the other benchmark algorithms at moderate and high CRs.

The implemented digitizer is a trigger device, where a deep learning module is implemented to pick the first arrival time of the event. We use the CapsPhase network as a picker module. CapsPhase achieves an accuracy of 94.77% in comparison of the STA/LTA, the MODWT, and the spectro-ratio which achieve an accuracy of 76%, 83%, and 87%, respectively. The system has a friendly user interface, which can monitor the seismic waveform in real

time, realize seismic data receiving, process and adjust the parameters of acquisition unit. Finally, the prototype achieves a reasonable performance when tested in a station within the Egyptian National Seismic Network (ENSN) compared to the calibrated digitizers in different stations.

Current Research Work

- ☐ Earthquake Early Warning (EEW) System design and implementation.
- ☐ Seismic signal processing.
- ☐ Deep learning.
- ☐ Cognitive wireless sensor networks.

Training Courses

Completed courses and have solid knowledge in:

- ☐ Python
- ☐ LabVIEW
- ☐ IELTS (Score: 6)
- ☐ Mobile Package
- ☐ PLC (Programmable Logic Controller).
- ☐ Microprocessor Based System.
- ☐ CCNA
- ☐ ICDL
- ☐ MATLAB
- ☐ C and C++
- ☐ EGYPTAIR Training
- ☐ Avionics Basic Course

Technical Skills

- Routing & Switch Configuration for LANS & WANS.
- Working in the VSAT seismic remote sites installation and maintenance
- Working in transmission of the seismic data through radio waves, its lab work and data bases.
- Installation and maintenance work for seismic stations that work via satellite, cellular and VHF networks.
- Managing servers via VMware ESXi and installation of linux operating systems and needed software and data processing.

Language Skills

Language	Reading	Writing	Conversation
Arabic	Excellent	Excellent	Excellent
English	Excellent	Excellent	Excellent

Academic Accomplishments

<https://scholar.google.com.eg/citations?hl=en&user=fTkbnokAAAAJ>

Refereed Journal Papers

Paper Title	Impact Factor
1. <u>E. B. Helal</u> , O. M. Saad, A. G. Hafez, Y. Chen, and G. M. Dousoky, "Seismic Data Compression Using Deep Learning," IEEE Access, vol. 9, pp. 58161–58169, 2021.	3.476
2. <u>E. B. Helal</u> , O. M. Saad, A. G. Hafez, and G. M. Dousoky, "Design And Implementation Of A Trigger Digitizer For Earthquake Monitoring System," JAET	-
3. <u>E. B. Helal</u> , O. M. Saad, A. G. Hafez, Y. Chen, and G. M. Dousoky, "Prototype Implementation of a Digitizer for Earthquake Monitoring System," <i>Sensors</i> , 2024. (Accepted and under publication)	3.9

Refereed Conference papers

Paper Title	Impact Factor
4. <u>E. Helal</u> , A. Khattab and Y. A. Fahmy, "Energy-efficient cluster head selection for cognitive radio sensor networks," 2016 28th International Conference on Microelectronics (ICM), Giza, Egypt, 2016, pp. 205-208, doi: 10.1109/ICM.2016.7847851.	-