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WIRELESS SENSOR NETWORKS

1.0 Faculty Information

Name: Dr. Babangida Zachariah
Email: babangidazachariah@gmail.com

2.0 Course Information

Course Title and Month Year	**Sensor Networks May, 2023**
Class days (For synchronous course)	Fridays
Class time (For synchronous course)	7:00PM
Course total contact hours	12Hrs.
Class location	NSRIC online platform
Prerequisites and/or co-requisites	N/A
Level: A, C, E, H, I, K12, M, P, S, T, U, V, W	Undergraduate/U

Note: The below classification of courses is related any areas of knowledge:
A: Advanced level academic level courses; **C**: Canadian Immigration Training Program; **E**: Executive courses; **H**: Higher-level courses (i.e., graduate courses); **I**: Intermediate courses (i.e., university preparatory courses – Grade XII+); **K12**: Foundational, and lower-level courses; **M**: Mid-level courses (i.e., undergraduate courses); **P**: Professional courses; **S**: Short/seminar courses; **T**: Training courses; **U:** Tutorial Courses; **V:** Vocational training courses; and **W**: Workshop courses.

3.0 Professor Information

Name	Babangida Zachariah
Title	Instructor
Contact Information	Email:babangidazachariah@gmail.com
Office Location	NSRIC online platform
Office Hours	Fridays, 10:00am – 11:00am EST

4.0 Course Description

Advancements in science, technology and engineering has brought us to an era of miniaturized devices capable performing some computational, storage, and communication tasks. It is the world of Internet of Things (IoT), which have found application in diverse fields of endeavors. From healthcare, transportation, homes, cities, so many others, too numerous to mention.

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Generally, sensors, apart of which IoT system are, have capabilities to either sense, actuate and/or communicate. That is, they may operate in a network in order to deliver usable and useful services. These networks are known to as Wireless Sensor Networks (WSN). The purposes of sensors and WSNs puts a constraint in their sizes and that, too puts constraints in the available resources such as energy, storage, and computational capabilities. These constraints make their design and operation considerably different from the traditional computer networks. Therefore, their design and developments takes into accounts these constraints. Particularly, the protocols and the network management strategies and techniques. This course provide foundational coverage of concepts, applications and simulation of WSNs. Topics covered include introduction to WSNs, network topologies, node discovery and communication. It also provides overview of application domains and examines their implementations in those domains. Finally, introduces learners to the use of simulators for WSNs prototyping.

5.0 Course Learning Outcomes

Upon successful completion of this course, students will be able to:

CLO1: Describe basic concepts of WSNs and differentiate between WSNs and traditional computer networks.
CLO2: Describe the WSN architectures and topologies.
CLO3: Describe and assess WSNs applications domains.
CLO4: Use a simulator to implement basic WSNs topology.

6.0 Course Materials

Online course materials

1) Online PowerPoint presentation slides in pdf form, and video/audio recording of lectures

Textbook and resources (If any)

1) Karl, H. and Willig, A. (2005). Protocols and Architectures of for Wireless Sensor Networks. ISBN-13 978-0-470-09510-2, John Wiley & Sons, Ltd. The Atrium, Southern Gate, Chichester, West West England.
2) Kim, D. S. and Tran-Dang, H. (2019). Industrial Sensors and Controls in Communication Networks. ISBN: 978—3-030-04926-3, Springer Nature, Switzerland.

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7.0 Academic Integrity

Students are encouraged to have a look at the NSRIC's statement of academic integrity at NSRIC website. It is noted that by signing this syllabus, you will acknowledge that you have understood that any detected plagiarism should be reported.

8.0 Assessment for Grade

The course grade is only related to the academic courses (i.e., K12, and university level courses) based on individual and team performance as shown in Table 1:

Table 1: NSRIC grading system

Type of Assessment	Grade %
Participation/Engagement/Performance	10%
Assignments	20%
Midterm Exam I	20%
Midterm Exam II	20%
Final Exam	30%
Total	**100%**

Important Note:

i) The below classified courses (i.e., academic courses) will only be evaluated based on the grade system shown in Table 2. A grade and certificate will be issued for the student(s) and participant(s).
A: Advanced level academic level courses; **H**: Higher-level courses (i.e., graduate courses); **I**: Intermediate courses (i.e., university preparatory courses – Grade XII+); **K12**: Foundational, and lower-level courses; **M**: Mid-level courses (i.e., undergraduate courses).

ii) The below classified courses will **not** be evaluated based on the grade system shown in Table 2. A certificate will be issued for the student(s) and participant(s).
E: Executive courses; **P**: Professional courses; **S**: Short/seminar courses; **T**: Training courses; **U:** Tutorial Courses; **V:** Vocational training courses; and **W**: Workshop courses.

Participation/Engagement/Performance

Your participation in every aspect of the course is important for the learning process. Your engagement in every discussion in the course, due delivery of all assignments, quizzes, and research projects will be fruitful. These efforts from your side will reflect your performance in

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the course delivery and your commitments. This performance is the reflection of your dream grade!!

Assignments

You will be given **2 assignments** during the course delivery. The due dates for assignments are specified in the course content and schedule section. The assignments will be given time to time to solve/answer during the term. Assignments will be posted through NSRIC online platform at least one week before they are due. Due dates are given in course schedule (tentative schedule). However, in case of any special circumstance, the date will be posted beforehand or announced in class.

Midterm and Final Exams

Two midterm exams and one final exam will be taken according to the NSRIC policies and guideline. The exams would be through NSRIC online platform. The midterm and final exams dates would be announced by the course instructor/NSRIC administration.

9.0 Grading Scale of the Course

Important Note:

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ii) The below classified courses will **not** be evaluated based on the grade system shown in Table 2. A certificate will be issued for the student(s) and participant(s).

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At the end of the term, the below Table 2 will be used for translating your marks into a "Latter Grade" based on NSRIC grading policy.

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Table 2: NSRIC grading system

Marks	Letter Grade	Points	Description
≥ 93	A+	4.00	Outstanding
≥ 90	A	3.75	
≥ 87	A-	3.50	Excellent
≥ 84	B+	3.25	Very good
≥ 81	B	3.0	
≥ 78	B-	2.75	Moderately Good
≥ 75	C+	2.50	Good
≥ 72	C	2.25	
≥ 69	C-	2.0	Moderately Good
≥ 66	D+	1.75	Pass
≥ 63	D	1.50	
≥ 60	D-	1.25	Poor Pass
< 60	F	0	Failing

10.0 Advice and additional requirements

I advise you to:

- Please contact me if you need any help.
- Students are expected to attend all scheduled online lecture classes.
- Students are expected to study from the course materials and/or textbooks which will help to easily read and understand.
- Students are encouraged to write their own notes during lectures/presentations (pdf PowerPoint presentations, and additional materials if any).
- Students are encouraged to attend online platform classes on time because late-attendee disrupts the flow of the class for both the instructor and the other students.

Additional information (During Online Course offering Period)

- The PowerPoint course materials, and video lectures will be available at the NSRIC Platform.
- There will be scheduled discussion/tutorial sessions on **every Sunday** at the class scheduled time. All students must attend this session.
- There will be an office hour for students on Sunday from **3:00 pm – 4:00 pm**, Toronto, Canada time. Students need to send an email request so that a zoom meeting can be arranged. In addition, any time student can set up an online appointment (i.e., phone, zoom, and/or other mode of communications) based on

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availability of the course instructor. However, student should send an email request for setting up this type of meeting.

11.0 Course Topics

- Introduction to Wireless Sensor Networks
- Applications of Sensors and WSNs
- Single Sensor Node Architecture
- Wireless Sensor Network Architectures
- WSNs Topologies
- Routing in WSNs
- Simulation of WSNs

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12.0 Course Contents and Schedule

Lec No.	Module	Topics	Remarks
01	Introduction and Application of WSNs	Course overview, setting expectations, Introduction to WSNs, as well as application domains and Scenarios	
02	Foundations of WSN	Fundamentals of WSNs	
03	Single Node Architecture I	Components WSNs Node, Energy supply and consumption	
04	Single Node Architecture II	Runtime Environment for Sensor Nodes and Case Study (Contiki-NG/TinyOS)	
05	Network Architectures I	Network Scenarios and Optimizations	
06	Network Architectures II	Design Principles and Gateway Concepts	Assignment 1 due
		Mid Term Exam 1	**6th Lecture**
07	WSN Topologies	Overview of typical networks Topologies and Introduction to WSNs Topologies	
08	Routing I	Proactive and Reactive Protocols in WSN	
09	Routing II	Energy Efficiency in Routing	
		Mid Term Exam 2	**6th Lecture**
10	Simulation I	Setting up Simulation Environment and Simulation of Single Node Architecture	
11	Simulation II	Client-Server Model in WSNs and RPL Border Router Simulation	Assignment 2 due
12	Simulation IV	Energy Efficiency in Routing Protocols	
	Final Exam	**TBA**	

Our Specializations:

1. **ADK:** to create different avenues and opportunities for the **Acquisition and Dissemination of Knowledge**.
2. **BD:** to create **business development** relationship for the growth of the institution and to market products in the world.
3. **CS:** to facilitate **cybersecurity solutions** and to create opportunities on cybersecurity hands-on training to our students.
4. **OE:** to offer different courses for Human Resource Development through the NSRIC **Online Education** platform.
5. **RID:** to conduct **Research, Innovation and Development** in the areas of your interest and expertise.