FUTURE UNIVERSITY IN EGYPT جامعة المستقبل

Faculty of Engineering & Technology

Design of Real-Time Embedded Systems

Information :

Course Code :	CMP 456	**Level :**	Undergraduate	**Course Hours :**	2.00- Hours

Department : Specialization of Mechatronics Engineering

Instructor Information :

Title	Name	Office hours
Associate Professor	Mohamed Hassan Mohamed Elmahlawy	
Teaching Assistant	Shahd Ahmad Samir Ibrahim	

Area Of Study :

The overall aims of this course are:
ÅEnrich students' knowledge of the disciplinary foundation of embedded systems as well as insight into current research and development work.
ÅTrain the students' to identify, formulate and deal with issues of embedded systems independently and creatively.
ÅReinforce students' ability to model, simulate, and integrate technological solutions to design an embedded system.
ÅTrain students' to develop skills in laboratory and project assignments which require gathering of information and critical evaluation.

Description :

Introduction to bus architectures and programming; Device and system firmware; Arduino and I/O architectures; Memory architectures; Interrupt service routines; Real-time clocks/timers; Real-time debugging techniques and tools; Development and testing techniques; Students will be introduced to the full embedded system design process including: analysis, design (using extended finite state machine specification), interfacing, programming, hardware assembly, integration and system testing.

Course outcomes :

a.Knowledge and Understanding: :	
1 -	Describe the architecture of the embedded systems used in Mechatronics applications.
2 -	Demonstrate the principles of the design of embedded systems for various fields of mechanical engineering and, in particular, mechatronics engineering discipline.
3 -	Identify at least one programming language can be used for a microcontrollers.
b.Intellectual Skills: :	
1 -	Develop computer programs for engineering applications including programming of microprocessor based units.
2 -	Analyze electrical and electronics circuits including logic circuits, and microprocessor based mechatronics systems .
3 -	Solve microcontroller design problems related to mechanical engineering.
4 -	Evaluate designs, processes, and performance and propose improvements.

c.Professional and Practical Skills: :	
1 -	Use measuring instruments and laboratory equipment to design experiments of embedded systems, collect, analyze and interpret results.
2 -	Apply gained hardware and software skills to create and design embedded applications in mechatronics and its applications.
3 -	Use the basic organizational and project management skills.
d.General and Transferable Skills: :	
1 -	Collaborate effectively within multidisciplinary team
2 -	Search for information and engage in life-long self-learning discipline through self-learning assignments.
3 -	Refer to relevant literatures in project report.

Course Topic And Contents :

Topic	No. of hours	Lecture	Tutorial / Practical
Introduction to embedded processors and C programming.	4	2	2
Arduino embedded system design platform, Arduino basic circuit diagrams	6	4	2
Timers, debugging, and pulse width modulation (PWM), analog input	6	4	2
Communication protocols (UART, SPI, I2C), interrupts, and power management.	6	4	2
Embedded algorithms and feedback control	6	4	2
Peripherals and sensors	6	4	2
Embedded systems applications.	6	4	2
Final design project.	5	4	1
Total hours	45	30	15

Teaching And Learning Methodologies :

Interactive Lecturing
Problem solving
Discussion
Experiential Learning
Project
Research

Course Assessment :

Methods of assessment	Relative weight %	Week No	Assess What
Final Exam	40.00		
First Midterm	15.00		
Participation and Assessments	10.00		
Project	20.00		
Second Midterm	15.00		

Course Notes :
1-Lecture notes. 2-Handouts.

Recommended books :
Massimo Banzi, Getting Started with Arduino, O'Reilly books, 2011. Edward Lee and Sanjit Seshia, Introduction to Embedded Systems, A Cyber-Physical Systems Approach, LeeSeshia.org, 2011