

#### **ACE 225 – Microcontrollers**

Part II – Lecture 0

**Introduction to Part II** 

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Spring 2017

#### **Embedded System:**

- Computer hardware system having software embedded in it.
- Microcontroller/Microprocessor based system which is designed to perform a specific task.
- Independent system or it can be a part of a large system.





![](_page_2_Figure_1.jpeg)

#### Humanoid Robot

#### Flying Robot (Quadcopter)

![](_page_3_Figure_3.jpeg)

**Prosthetic Hand** 

![](_page_4_Picture_2.jpeg)

#### **Embedded System Companies in Egypt**

![](_page_5_Picture_1.jpeg)

![](_page_5_Picture_2.jpeg)

![](_page_5_Picture_4.jpeg)

#### **MENTOR GRAPHICS (EGYPT)**

![](_page_5_Picture_6.jpeg)

**SWIFTORNIX** 

#### **Rule of Microcontroller in Embedded System**

![](_page_6_Figure_1.jpeg)

![](_page_6_Figure_2.jpeg)

#### **Rule of Microcontroller in Embedded System**

#### Embedded Systems

Operations managed behind the scenes by a micro-computing device.

#### Microcontroller (MCU)

- Integrated electronic computing device that includes three basic major components on a single chip:
- Basic Units
  - Microprocessor (MPU)
  - Memory
  - I/O (Input/Output) ports
- Support Units
  - Serial Communication Interrupts
  - Timers PWM
  - A/D converter

![](_page_7_Figure_13.jpeg)

# Part II ..... Agenda

![](_page_8_Figure_1.jpeg)

# **Course Part II ILO's**

Upon successful completion of this part of the course, the student will be able to:

- **Implement a UART Communication between MCUs and PC.**
- Read and Process an analog signals using MCU.
- Use timers to produce a precise timing.
- Recognize interrupts and how to implement inside MCU.
- **Generate PWM signal to control the power delivered to a load.**

![](_page_9_Picture_7.jpeg)

### **Course Assessment**

![](_page_10_Figure_1.jpeg)

## **Course Project**

#### **Topics**

#### Implementation of a mini embedded system that satisfies the following criteria:

- Solves a mini real world problem.
- Utilizes the capabilities of MCU such as reading and processing of digital and analog inputs, communication with PC for monitoring and remote control, control a digital output, Interrupts, Timers, and PWM.

#### Some suggested topics [Optional]

- Control direction of a DC motor via hand gesture + Monitoring.
- Control direction of a DC motor via head gesture + Monitoring.
- Temperature ON/OFF control of a box (incubator) + Monitoring.
- Human Detection using Sonar sensor + Motor (on/off) + buzzer + Monitoring.
- Water Level Indicator.
- Street Light that Glows on Detecting Vehicle Movement.

# **Course Project**

#### <u>Teams</u>

The team should include 10 students who will divide themselves into sub-teams working on the software and hardware developments.

#### **Project Presentation & Evaluation:**

- Each team must prepare a CD for the course Teaching Assistant containing all materials related to the project (Well-documented project technical report + Software). <u>Only printed copy of technical report</u>.
- The project evaluation will be based on the following criteria:
  - **Project management [10%]:** Cooperation Duties distribution Problem solving Team players
  - Software [40%]: Open source or your own Ease of use and operability Accuracy Output graphics.
  - **Experimental Hardware [30%]**: Stability and reusability Precision Cost optimization.
  - Final Report [20%]: Technical report format [Cover, TOC (Table of Contents), Introduction, Motivation, Objectives, Methodology, Results (Simulation + Experimental), References].
  - Novelty [10% bonus]: You have to prove to what extend the idea is novel.

### **Course Project**

#### **Project Delivery**

- The project (Hardware + Software + Report + CD) will be delivered to the Teaching Assistant.
- Every group of teams will be assigned to one of the Teaching Assistant who will deliver and evaluate the project based on the previous criteria.
- The Teaching Assistant will not return the hardware to the team members.
- The project can be delivered on a PCB or test board. However, it is better to use a breadboard.
- Make a contact with your TA to determine a time for the project delivery and evaluation.

### **Course Part II Resources**

#### https://fee-ace225-spring17.slack.com/signup

By using .edu mail: @el-eng.Menofia.edu.eg

- Course Part II Website: Slack Page: <u>https://fee-ace225-spring17.slack.com</u>
- Course material Course announcements Discussions etc. . .
  - Desktop/Mobile app
- Course Part II Instructor:
  - Dr. Ahmed Khalifa
  - Email: <u>ahmed.khalifa0687@gmail.com</u>
  - Office: Control Building Ground floor
  - Office hours: 2 hrs. after lecture

![](_page_14_Picture_11.jpeg)

# What is expected of you in this course?

- Download all handouts from the specified internet site and check it frequently.
- Attend all Lectures and Labs.
- Read the assigned portions of the book (The lectures are not a substitute for reading the book).
- Do the assignments and submit them.
- Assignment(s) on Part II [Optional No Grading] (They will be delivered (checked) to (by) Teaching Assistant)
- Do the project and submit it in a standard form.
- You really must start the projects as soon as possible you cannot throw them together at the last minute and have a good result!

# What is expected of you in this course?

You are expected to approach this course with the philosophy of education in mind, as described in the undergraduate catalog, "...The educated people should be able to cope with change, to learn by themselves, to think for themselves, to analyze and deal with problems in a confident and realistic manner."

- It is not possible to cover all of the course varied aspects in the lectures.
- Therefore, the readings, quizzes, and project may deal with topics NOT specifically covered in class lectures.
- Nevertheless, you are expected, in the spirit of the education philosophy, to extend yourself, learn on your own, and rise to the challenges of the course objectives.

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#### **Lecture End**

# Questions?

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