COMMUNICATION ENGINEERING AND ELECTRONIC TECHNOLOGIES

(Lecce - Università degli Studi)

Insegnamento SIGNALS ACQUISITION AND ELECTRONIC DESIGN

GenCod A005493

Docente titolare Paolo VISCONTI

Insegnamento SIGNALS ACQUISITION AND ELECTRONIC DESIGN

Insegnamento in inglese SIGNALS ACQUISITION AND ELECTRONIC DESIGN

Settore disciplinare ING-INF/01

Corso di studi di riferimento COMMUNICATION ENGINEERING AND

Tipo corso di studi Laurea Magistrale

Crediti 9.0

Ripartizione oraria Ore Attività frontale: 81.0

Per immatricolati nel 2021/2022

Erogato nel 2022/2023

Anno di corso 2

Lingua ITALIANO

Percorso Electronic Systems and Technologies

Sede Lecce

Periodo Secondo Semestre

Tipo esame Orale

Valutazione Voto Finale

Orario dell'insegnamento https://easyroom.unisalento.it/Orario

BREVE DESCRIZIONE DEL CORSO

Overview

This course embraces themes of sensing and transduction, signal acquisition, design of analog/digital circuital blocks, analysis of embedded systems and an overview on rapid prototyping solutions for advanced electronic design. These are vital subjects for any system which extracts signals from the real world and processes the information digitally. The course comprises information on signals, sensor and transducer principles, related applications, embedded electronic design for signal acquisition and finally design and testing, by using a specific software, of an electronic acquisition board managed by a microcontroller. Also the course aims to provide an overview on the hardware and software platform related to Arduino prototyping board. By initially addressing the basic concepts related to Arduino board and IDE programming, the course introduces the Arduino hardware, its interfacing with sensors, components and accessories in order to give an overview on rapid prototyping solutions for Arduino-based electronic design. Furthermore, the principles of ATMEGA micro-controllers programming are addressed with the aim to read correctly signals provided by the interfaced sensors and to drive load such as motors / actuators. Finally, the realization and testing of realized prototypes during course are performed. In addition a comparison of features and performance between Arduino prototyping board and the Raspberry PI 3 platform, is carried out, in order to be able to choose the most suitable architecture for a specific application, as function of the development board / microcontroller characteristics.

Course Contents

- Introduction: sensors, transducers, processing devices and smart units.
- Block scheme of channel for signal and information acquisition and processing.
- Physical principles of sensors and transducers. Fundamental concepts: sensitivity, resolution, accuracy, linearity, offset, gain, signal-to-noise ratio, standard deviation, measurement error.
- Sensors: strain gauge, piezo-electric sensors, temperature sensors, light and radiation sensors, accelerometers, proximity sensors, magnetic field sensors, sensors of displacement, angle, speed, level, force, pressure, flow rate. Industrial and automotive applications of commecial sensors.
- Electronic sensing circuits, new generation intelligent (smart) sensors.
- Digital to analogue converters – internal structure and design. Analogue to digital converters - principal methods.
- Internal scheme, operation and programming of a microcontroller (PIC).
- Introduction to the Arduino platform: circuital schemes, embedded microcontroller, board pinout - Analog and Digital pins.
- Arduino Integrated Development Environment and firmware structure.
- Arduino board interfacing with sensors, transducers, actuators, processing devices and smart units with related firmware implementation.
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Prototypes realization and testing on proto-boards.

PREREQUISITI

Knowledge in analog and digital electronic, C++ programming.

OBIETTIVI FORMATIVI	**Learning Outcomes** After the course the student should be able to: * Understand the principles of operation of commonly used sensors, transducers, and instruments. * Define technical specifications and to select sensors and transducers for a given application. * Understand terminologies associated with instrumentation systems (e.g., range, sensitivity, dynamic response, calibration, hysteresis, error, accuracy, precision, data uncertainty, mean and standard deviation). * Use data acquisition software and hardware to collect and analyze data from a physical system. * Analyze and understand the operation of computerized instrumentation systems for industrial processes using multiple sensors, electronic interfaces, data acquisition boards based on microcontrollers. * Use commercial software for the design and simulation of electronic boards managed by a microcontroller * Gain experience in developing computerized instrumentation systems for industrial processes using multiple sensors, interface electronics, data acquisition smart boards. * Acquire an experience in designing an electronic acquisition system of physical quantities. * Understand the programming principles of Arduino prototyping platform (ATMEGA microcontroller). * Interface sensors and actuators with the Arduino prototyping board with the related reading and driving of the different interfaced devices. * Realize and test Arduino-based circuital protpotypes in order to verify the correct operation of the implemented electronic solutions.
METODI DIDATTICI	The course consists of lectures by using the slides provided to the students and laboratory activities related to the design and simulation of electronic solutions by the Proteus software. Also the teacher makes available on the website in addition to the slides of the lessons, further handouts to facilitate the understanding of the topics and the designing of the electronics systems. The final exam consists of an oral question on the theoretical topics of the course and in the presentation of a project realized by the student with the Proteus software.
MODALITA' D'ESAME	**Examination:** oral and project discussion related to Proteus software. The exam consists of an oral examination related the theoretical and practical contents of the course. In addition, the student has to present a circuital project realized with Proteus software and discuss its contents showing operation modes of designed electronic board managed by a microcontroller and related simulation results (maximum overall duration: two hours).
APPELLI D'ESAME	Esame orale + presentazione progetto
ALTRE INFORMAZIONI UTILI	**Office Hours:** By appointment; contact the instructor by email or at the end of class meetings.

PROGRAMMA ESTESO

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TESTI DI RIFERIMENTO

Teaching materials: teacher handouts.